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VOLUME I
SUMMARY

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Importance, will be subject to intensive evaluation of all factors relevant to the proposal, as most activities in these areas may seriously alter or destroy wetlands that are natural resources of critical importance to the people of the nation.

There are significant gaps in physical and biological information in the Snohomish estuary study area. Most notable is the lack of information on primary productivity, estuarine hydraulics, and wildlife habitat. A quantitative knowledge of the primary productivity of wetland plant species and habitat types is necessary to understand the biological contribution of an area to the estuarine ecosystem. An adequate description of the hydraulics of the estuary would allow both an analysis of the aquatic interaction between various habitat types and a determination of possible water quality problems. A complete understanding of habitat utilization by wildlife is an important aspect of the function of a habitat. This study was conducted using information on these and all other subjects. Additional data will provide important refinements to the evaluations conducted in this study.

VOLUME I

SNOHOMISH ESTUARY WETLANDS STUDY

Summary Report

Prepared for

U.S. Army Corps of Engineers
in accordance with
Contract No. DACW67-77-C-0103

by

Shapiro & Associates, Inc./Andrew L. Driscoll, Consultant

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EXECUTIVE SUMMARY

1. The Snohomish Estuary Wetlands Study (SEWS) has been conducted by the U.S. Army Corps of Engineers, Seattle District, under the authority of Section 404 of the Federal Water Pollution Control Act Amendments of 1972 as amended and Corps regulations 33 CFR 320-329. Section I of this report describes the basic authorities under which the study has been conducted and discusses the importance of wetlands as expressed in national policies. The study has four volumes, as follows:

- . Volume I, Summary
- . Volume II, Base Information and Evaluation
- . Volume III, Classification and Mapping
- . Volume IV, Delineation of Wetland Boundaries in the Snohomish Estuary

The study provides a basis for the environmental evaluation of public interest factors and a factual body of physical, biological, public policy, and land use information for the Snohomish estuary study area, to be used in the environmental evaluation and review of Corps Section 10 and Section 404 permit applications. Wetlands and areas of particular importance or concern in the study area are identified and described. A method for the assessment of the specific and cumulative impacts of proposed permit activities is presented.

2. The study area (Section III) includes the entire 100-year floodplain of the Snohomish River north of its confluence with Ebey Slough, Everett Harbor, the north shore of Possession Sound including Tulalip Bay and adjacent upland boundaries. Emphasis is on the floodplain and areas under Corps jurisdiction; the upland areas are included because activities there may influence wetlands and floodplain areas. The permit review process as carried out by the Seattle District is described in Section IV.

3. The major findings of the study are summarized in Section V. The first major finding is an identification and classification of all wetlands in the study area (from Volume III) and a detailed description of the characteristics, distribution, history, and significant relationships and functions of each wetland type. The importance of all wetlands and the requirement to preserve and protect them as affirmed by Corps regulations 33 CFR 320.4 is emphasized. The second major finding is a designation of certain areas within the study area as Areas of Importance or Areas of Environmental Concern. The designation reflects the extent to which particular areas are considered to be vital to the continued functioning of the estuarine ecosystem and vital to the public interest. The cri-

teria used in identifying areas to be considered Areas of Importance or Areas of Environmental Concern are directly derived from the stated policies of the Corps of Engineers (33 CFR 320.4) and of other federal, state, regional, and local agencies. Wetlands in Areas of Importance should be considered Wetlands of Importance as per Corps regulations 33 CFR 320.4(b)(2) and 33 CFR 320.4(b)(4). Areas of Importance and Areas of Environmental Concern are shown in Plate 2.

4. Section V also contains a general description of the environmental impacts of typical permitted activities in the Snohomish estuary study area. A method for the assessment of specific and cumulative impacts of permitted activities in the study area is outlined; it is designed to be used primarily by Seattle District personnel in reviewing permit applications. Section V also contains a description of the factors influencing the location of development in the study area and defines general areas in which pressure to develop is low, medium, or high.

5. Section VI of this volume summarizes information on the physical and biological characteristics of the estuary and public policy and land use trends in the study area. Supporting information for the description of wetlands and designation of Areas of Importance/Areas of Environmental Concern may be found in Section VI and in Sections VI and VII of Volume II.

6. In sum, the study underlines the importance of wetlands and provides a detailed identification and evaluation of all wetlands in the study area. The study recognizes that in consideration and evaluation of wetlands, the adjacent habitat types must also be considered, for such areas may have characteristics essential to the continued physical and biological function of the wetlands. Therefore, Areas of Importance and Areas of Environmental Concern should be considered as habitat units, of which wetlands are an integral part. Permit applications in such areas, particularly in Areas of Importance, will be subject to intensive evaluation of all factors relevant to the proposal, as most activities in these areas may seriously alter or destroy wetlands that are natural resources of critical importance to the people of the nation.

7. There are significant gaps in physical and biological information in the Snohomish estuary study area. Most notable is the lack of information on primary productivity, estuarine hydraulics, and wildlife habitat. A quantitative knowledge of the primary productivity of wetland plant species and habitat types is necessary to understand the biological contribution of an area to the estuarine ecosystem. An adequate description of the hydraulics of the estuary would allow both an analysis of the aquatic interaction between various habitat types and a determination of possible water quality problems. A complete understanding of habitat utilization

by wildlife is an important aspect of the function of a habitat. This study was conducted using available information on these and all other subjects. Additional data will provide important refinements to the evaluations conducted in this study.

USERS' GUIDE TO THE
SNOHOMISH ESTUARY WETLANDS STUDY
(SEWS)

1. The Snohomish Estuary Wetlands Study provides base information and methodology to be used in evaluating permit applications and the environmental effects of proposed activities.

2. The study is organized to be useful to Seattle District Corps personnel in reviewing permit applications; however, permit applicants and other agency personnel may also find the information and methods helpful. The permit process described in Section IV shows how a permit application is reviewed by Seattle District and identifies the major criteria used in the review. Section V.C contains a method for the assessment of the specific and cumulative impacts of proposed activities. This method will be most useful to Seattle District personnel, but may also be used by the applicant.

3. Should the applicant desire only more generalized information, the following guide to the document may be used:

A. Define the proposed activity and its location:

Activity _____ Location _____

B. Go to Section V, FINDINGS IN THE SNOHOMISH ESTUARY.

C. Review the information on impacts of various activities contained in Section V.C.

D. Determine from Plate 2, Section V.B, if the proposed site is in an Area of Importance or Area of Environmental Concern.

E. If so, review the detailed description of the Area of Importance or Area of Environmental Concern (Section V.B).

F. From the large-scale maps on file at the Seattle District office, determine whether the proposed site is in a Wetland Type (Section V.A). If so, review the detailed description of the Wetland Type.

G. If the proposed site is in an Area of Importance, Area of Environmental Concern, or Wetland Type, consult a Seattle District representative for assistance and information.

4. Every permit application submitted to the Seattle District will be subject to review under Corps regulations. If a proposed activity is located in an Area of Importance, Area of Environmental Concern, or Wetland Type, this does not mean that the permit application will automatically be denied.

Section I

INTRODUCTION

Section I

INTRODUCTION

1. The introduction describes the legal and regulatory authority under which the Seattle District, Corps of Engineers has conducted the Snohomish Estuary Wetlands Study and presents national policy affirming the importance of wetlands.

STUDY AUTHORITY

2. The Seattle District, U.S. Army Corps of Engineers, is engaged in the regulation of activities in or upon the navigable waters (or navigable water of the United States) and adjacent wetlands of the Snohomish River and Everett Harbor under provisions of Section 10 of the River and Harbor Act of 3 March 1899 (30 Stat. 1151; 33 U.S.C. 403), Section 404 of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500, FWPCA) as amended by the Clean Water Act of 1977, and other authorities as shown in Appendix B. Persons proposing to work in these navigable waters and wetlands are required to obtain permits from the Seattle District, Corps of Engineers, prior to initiating any contemplated activity including, but not limited to, dredging, filling, moorage, and other works affecting their navigational, fish and wildlife, water quality, economics, aesthetic, recreational, and other societal and ecological values. Section 10 permits cover the construction of any structure in or over any navigable water of the United States, the excavation from or depositing of material in such waters, or the accomplishment of any other work affecting the course, location, condition, or capacity of such waters. Section 404 permits are specifically for the discharge of dredged or fill material into the waters of the United States at specified disposal sites. The results of the Snohomish Estuary Wetland Study will be used in review of both Section 10 and Section 404 permit applications.

3. Under the authority of Section 404, FWPCA, as amended, and Corps regulations 33 CFR 320-329 (Appendix D), the District Engineer, Seattle District, Corps of Engineers, has conducted this study of wetlands and associated aquatic resources of the Snohomish estuary that serve important purposes relating to fish and wildlife, recreation, water quality, and other elements of the general public interest. The study has identified and evaluated wetlands, defined by Corps regulations (33 CFR 323.2(c)) as follows:

"The term 'wetlands' means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for

life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

Vegetated intertidal areas are included under this definition. The study has also identified and evaluated aquatic resources related to wetlands, including mudflats and other estuarine shallows. Executive Order 11990 (see below) lends strong support to the need to include aquatic resources related to wetlands in the scope of this study.

4. Under Corps regulations a general policy for evaluation of permit applications indicates that "no permit will be granted unless its issuance is found to be in the public interest" (33 CFR 320.4(a)). Factors of the public interest include the conservation and preservation of wetlands, fish and wildlife resources, water quality, and historic, scenic, and recreational values (33 CFR 320.4(b)-(e)). Further, under Corps regulations 33 CFR 320.4(b)(4), no permit will be granted for work in wetlands identified as important under 33 CFR 320.4(b)(2) unless the benefits of the proposed work outweigh the damage to the wetlands resource and the proposed alteration is necessary to realize those benefits. Under 33 CFR 320.4, the interrelated nature of wetlands and the cumulative effects of numerous piecemeal alterations of wetlands that may result in a major impairment of the wetlands resource must be evaluated. The Snohomish Estuary Wetlands review has considered such effects. The Corps criteria for identification of wetlands important to the public interest (33 CFR 320.4(b)) are central to the identification and evaluation of wetlands made in this study (Section V.B).

IMPORTANCE OF WETLANDS

5. The Chief of Engineers' Policy on Wetlands emphasizes the importance of wetlands as a public resource. The policy is contained in its entirety in Appendix A; parts of it are reprinted here.

Chief of Engineers' Policy on Wetlands:

- a. Wetlands are vital areas that constitute a productive and valuable public resource, the unnecessary alteration or destruction of which should be discouraged as contrary to the public interest.
- b. Wetlands considered to perform functions important to the public interest include:
 - 1) Wetlands which serve important natural biological functions, including food chain production, general habitat, and nesting, spawning, rearing and resting sites for aquatic or land species;

- 2) Wetlands set aside for study of the aquatic environment or as sanctuaries or refuges;
- 3) Wetlands the destruction or alteration of which would affect detrimentally natural drainage characteristics, sedimentation patterns, salinity distribution, flushing characteristics, current patterns, or other environmental characteristics;
- 4) Wetlands which are significant in shielding other areas from wave action, erosion, or storm damage. Such wetlands are often associated with barrier beaches, islands, reefs and bars;
- 5) Wetlands which serve as valuable storage areas for storm and flood waters;
- 6) Wetlands which are prime natural recharge areas. Prime recharge areas are locations where surface and groundwater are directly interconnected; and
- 7) Wetlands which through natural water filtration processes serve to purify water.

.....

- d. No construction activity will be performed in wetlands identified as important by subparagraph b, above, unless the District Engineer concludes that the benefits of the proposed alteration outweigh the damage to the wetlands resource and the proposed alteration is necessary to realize those benefits. In evaluating whether a particular alteration is necessary, the District Engineer shall consider whether the proposed activity is primarily dependent on being located in, or in close proximity to, the aquatic environment and whether feasible alternative sites are available. The District Engineer must demonstrate the need to locate the proposed activity in the wetland and must evaluate the availability of feasible alternative sites.

.....

The Chief's policy is virtually the same as found in Corps regulations 33 CFR 320.4. It is this regulation under which all permit applications for work in wetlands are reviewed. The emphasis on wetlands as vital areas constituting a valuable public resource indicates the importance given in Corps regulations to all wetlands.

6. Executive Order (EO) 11990, issued by President Jimmy Carter on 24 May 1977, reiterates the need to preserve and protect wetlands

as a national policy. The President's statement accompanying EO 11990 emphasizes wetlands as vital natural resources of critical importance to the people of the country. EO 11990 orders federal agencies to minimize the destruction of wetlands and to preserve and enhance the values of wetlands in management of federal lands, construction, and programs. EO 11990 does not apply to the issuance of Corps permits for activities on non-federal property. In EO 11990, wetlands are defined as follows:

"The term 'wetlands' means those areas that are inundated by surface or ground water with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mudflats, and natural ponds."

This definition is broader than the definition used by the Corps of Engineers in administering their permit program under Section 404, FWPCA (33 CFR 323.2(c)); for example, unvegetated mudflats are here defined as wetlands. EO 11990 and the President's statement are in Appendix A.

7. Executive Order 11988, also issued 24 May 1977, is an order to federal agencies to preserve the natural and beneficial values of floodplains in management of federal lands, construction, and programs. The President's statement accompanying EO 11988 emphasizes the special values of the floodplains adjoining the nation's waters and calls for active floodplain management. EO 11988 and the President's statement are in Appendix A. Corps regulations 33 CFR 239 for implementation of EO 11988 are in Appendix D.

8. In sum, the importance of wetlands as a vital resource is expressed in the policy of the Chief of Engineers, reiterated in the regulations of the Corps of Engineers, and emphasized in Executive Orders as national policy.

Section II

SCOPE OF STUDY

Section II

SCOPE OF STUDY

1. Section II describes the purpose, objectives, and assumptions of the Snohomish Estuary Wetlands Study.

STUDY PURPOSE AND OBJECTIVES

2. The purpose of the Snohomish Estuary Wetlands Study is to provide an objective basis for the evaluation of permit requests for development activities in wetlands and associated aquatic resources of the Everett, Washington, area. The principal users of the study will be Corps personnel involved in review of permit applications, planning of water resource projects, and environmental assessment. Results may also be used by permit applicants as well as concerned federal, state, and local agencies in evaluating the impacts of particular activities on wetlands and associated resources. The Snohomish estuary was chosen for the wetland study for primarily three reasons. First, the area has a history of significant permit activity and a probable future of continued permit demand. Second, it is a major port area where the Corps of Engineers is involved in the planning of proposed projects and the operation of existing projects, as well as in regulatory activities. Third, the Snohomish estuary contains diverse wetlands and habitats.

3. The Snohomish Estuary Wetlands Study has three components: (a) Classification and Mapping; (B) Delineation of Corps Jurisdictional Boundaries; and (C) Base Information and Evaluation. To provide an understanding of the scope of the study, all three (I) components are briefly described below. Volume II represents Component C, Volume III is Component A, and Volume IV is Component B.

4. Component A. Classification and Mapping. The objective of Component A was to classify and map wetlands in the study area from a biological perspective. This component has been completed and has resulted in a classification of study area lands, wetlands, and aquatic areas into seven different habitat types (e.g. urban, aquatic lands) at four levels of detail. These habitat types have been mapped at the most detailed level. The classification and mapping results are discussed and used in Section VI.B, Biological Profile, of this document.

5. Component B. Delineation of Corps Jurisdictional Boundaries. The objective of this component was to delineate the boundaries of the Corps of Engineers 404 permit jurisdiction in wetlands of the study area as interpreted from Corps of Engineers permit regulations (33 CFR 320-329). Completion of this component has

resulted in a set of maps showing the recommended line of Corps jurisdiction throughout the estuary. This component is discussed in Section III, Study Area, of this document.

6. Component C. Base Information and Evaluation. Component C has three principal objectives:

- 1) To synthesize and integrate background information pertinent to development of wetland evaluation guidelines and to preparation of a programmatic environmental impact statement (EIS) for the study area.
- 2) To evaluate the relative biological importance of various wetland types in the study area and to assess the impacts of typical development activities in the study area on these wetlands.
- 3) To identify land use trends in the study area and relate this information to the potential cumulative impacts of permit activities on wetlands and other aquatic areas.

Volume II represents the synthesis and integration of base information on the physical and biological and public and land use characteristics of the Snohomish estuary study area. It contains an identification of study area lands and wetlands, a description and evaluation of all wetlands and associated aquatic resources in the study area, and identification and description of areas to be considered Areas of Importance and Areas of Environmental Concern based on their physical, biological, and public and land use characteristics. It also contains a description of activities and their impacts on wetlands/aquatic resources (Section V.C) and a discussion of land use trends and development pressure (Section V.D) in the estuary. It is designed to provide a method (Section V.C) and the necessary base information for evaluation of the specific and cumulative effects of typical development activities on lands and wetlands of the study area. In so doing, it establishes an objective basis for the evaluation of permit applications in the Snohomish estuary study area.

STUDY ASSUMPTIONS

7. The following assumptions were made at the outset of the study:

- 1) That sufficient physical and biological data existed or could be extrapolated to provide a meaningful natural profile description of the Snohomish estuary. With the exception of some water temperature and salinity measurements (completed under Component B), ground-truth checks of aerial photo interpretations and visual/aesthetic characterization, no field studies were undertaken.

- 2) That stated policies of federal, state, regional, and local agencies are expressions of the public interest at the national, state, and local level, and further, that any areas called out in agency policy as areas to be preserved from development are areas in which public interest is high.
- 3) That certain terms must be carefully defined for purposes of the study and used consistently through the report. These terms are listed and defined following:
 - a) Wetland: There are many definitions of "wetland"; five are listed here and others may be found in Appendix A.

"Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas." (Corps regulations 33 CFR 323.2(c))

"...those areas that are inundated or saturated by surface or groundwater at magnitude, frequency, and duration sufficient to select a plant community that tolerates such permanent inundation, periodic inundation or prolonged near surface soil saturation during the growing season. Certain unvegetated areas are also considered wetlands...These include such living assemblages as coral reefs, oyster bars, and clam flats; areas essential to and functionally related to wetlands including fluctuation zones and some transition zones where the inclusion of such an edge is essential to maintaining the functional integrity of the wetland; shallows, and flats, generally near wetlands, that are valuable, definable and where the food chain for the animal community is in part dependent on detrital export from the nearby wetlands. (Macomber, 1978)

"Lowlands covered with shallow and sometimes temporary or intermittant waters...referred to as marshes, swamps, bogs, wet meadows, potholes, sloughs and river overflow lands." (Shaw and Fredine, 1956 (Circular 39))

"...land where the water table is at, near or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes. In certain types of wetlands, vegetation is lacking and soils are poorly developed or absent as a result of frequent and drastic fluctuations of surface-water levels, wave action, water flow, turbidity or high concentrations of salts or other substances in the water or substrate. Such wetlands can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deep water habitats." (Cowardin, et. al., 1977)

"Naturally vegetated areas located between mean high water and the yearly normal maximum floodwater level." (Clark, 1974)

For purposes of this study, the Corps 404 definition (33 CFR 323.2(c)) is used. It is important to note that this definition is based on vegetation, so that unvegetated mudflats are not wetlands by this definition.

- b) Tidal Datum Planes: "A plane of reference for elevations, determined from the rise and fall of the tides" (Marmer, 1951). Examples include mean high water, mean low water and mean tide level.
- c) Tidelands: "All lands over which the tide ebbs and flows from the line of ordinary high tide to the line of mean low tide, except in front of cities where harbor lines have been established, where tidelands are the area between the line of ordinary high tide and the inner harbor line, excepting oyster lands" (Wa DNR Marine Land Management Division Manual 5109 01.03).
- d) Habitat: "Place where a plant or animal normally lives, often characterized by a dominant plant form or physical characteristic" (Ricklefs, 1973).
- e) Habitat Type: As used by Burrell (1978), a vegetative community, or, in the case of unvegetated aquatic lands, a substrate type, or, in the case of urban lands, a use or activity.

- f) Aquatic Lands: "lands which are either covered by water or strongly influenced by adjacent waters" (Burrell, 1978).
- g) Intertidal: "Bounded by the high and low water extremes of the tide" (Sverdrup, et. al., 1970). The region between extreme lowest water (-4.5 feet MLLW) and extreme highest water (14.5 feet MLLW) in the study area.
- h) Estuary: "That part of the lower river course that is affected by the mixing of salt water and fresh" (Fairbridge, 1968). In this study estuary includes the river and adjacent sloughs downstream from the confluence of the Snohomish River and Ebey Slough (see Hydraulics, Section VI).
- i) Mudflats: Broad mud and/or sand deposits at intertidal elevations. Often located at a river mouth, non-vegetated mudflats are not wetlands according to the definition contained in Corps permit regulation 33 CFR 323.2.
- j) Navigable Waters: "Those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce" (33 CFR 329.4).
- k) Waters of the United States: "The territorial seas; coastal and inland waters, lakes, rivers and streams that are navigable waters of the United States, including adjacent wetlands; tributaries to navigable waters of the United States, including adjacent wetlands; interstate waters and their tributaries, including adjacent wetlands; and all other waters of the United States. (33 CFR 323.2)

Other terms which are defined in 33 CFR 323.2 (Appendix D) include:

- . Adjacent (33 CFR 323.2(d))
- . Ordinary High Water (33 CFR 323.2(g))
- . High Tide Line (33 CFR 323.2(h))
- . Dredged Material (33 CFR 323.2(k))
- . Fill Material (33 CFR 323.2(m))

Section III

THE STUDY AREA

Section III

THE STUDY AREA

OVERVIEW

1. The Snohomish estuary is located adjacent to the city of Everett, approximately 30 miles north of Seattle, in Snohomish County, Washington (Figure III-1). The estuary system includes the main channel of the Snohomish River and Ebey, Steamboat and Union Sloughs. The estuary is about 9 miles long and 2.5 to 4 miles wide; it encompasses about 20 square miles in six major islands. In the Puget Sound region it is second only to the Skagit River in size and average annual discharge. A more detailed description of the physical characteristics of the study area may be found in the Topography and Geography section (Section VI, Volume II).

2. Adjacent to the estuary are three population centers: Everett, Marysville, and the Tulalip Indian Reservation. Everett has a population of about 54,000 persons (1970 Census); Marysville 4,000, and the Tulalip Reservation about 3,500 (Drost, 1977).

DESCRIPTION OF THE STUDY AREA

3. The study area includes the entire 100 year floodplain of the Snohomish River north of its confluence with Ebey Slough, Everett Harbor, the north shore of Possession Sound including Tulalip Bay, and adjacent upland areas (Plate 1). The approximate 100 year floodplain is the area which would be inundated by a flood of a magnitude expected to be equaled or exceeded only once every 100 years on the average. In the Snohomish Basin the 100-year floodplain was mapped by the Corps in 1967; it is approximately 8.5 feet above sea level at the mouth of the river and 18 feet above sea level at the confluence of Ebey Slough.

4. The study area is made up of uplands, aquatic areas, and intertidal lands. Uplands includes all land not inundated by the tide. Included within this definition are the diked islands of the floodplain (which would be inundated if there were no dikes). Intertidal lands are those areas with an elevation between extreme low water (approximately -4.5 feet MLLW) and extreme high water (approximately 14.5 feet MLLW at Everett). The aquatic area encompasses all the waters of the area. This includes the marine waters west of the river mouth (Priest Point to Preston Point) and the estuarine waters, from the river mouth to the confluence of Ebey Slough.

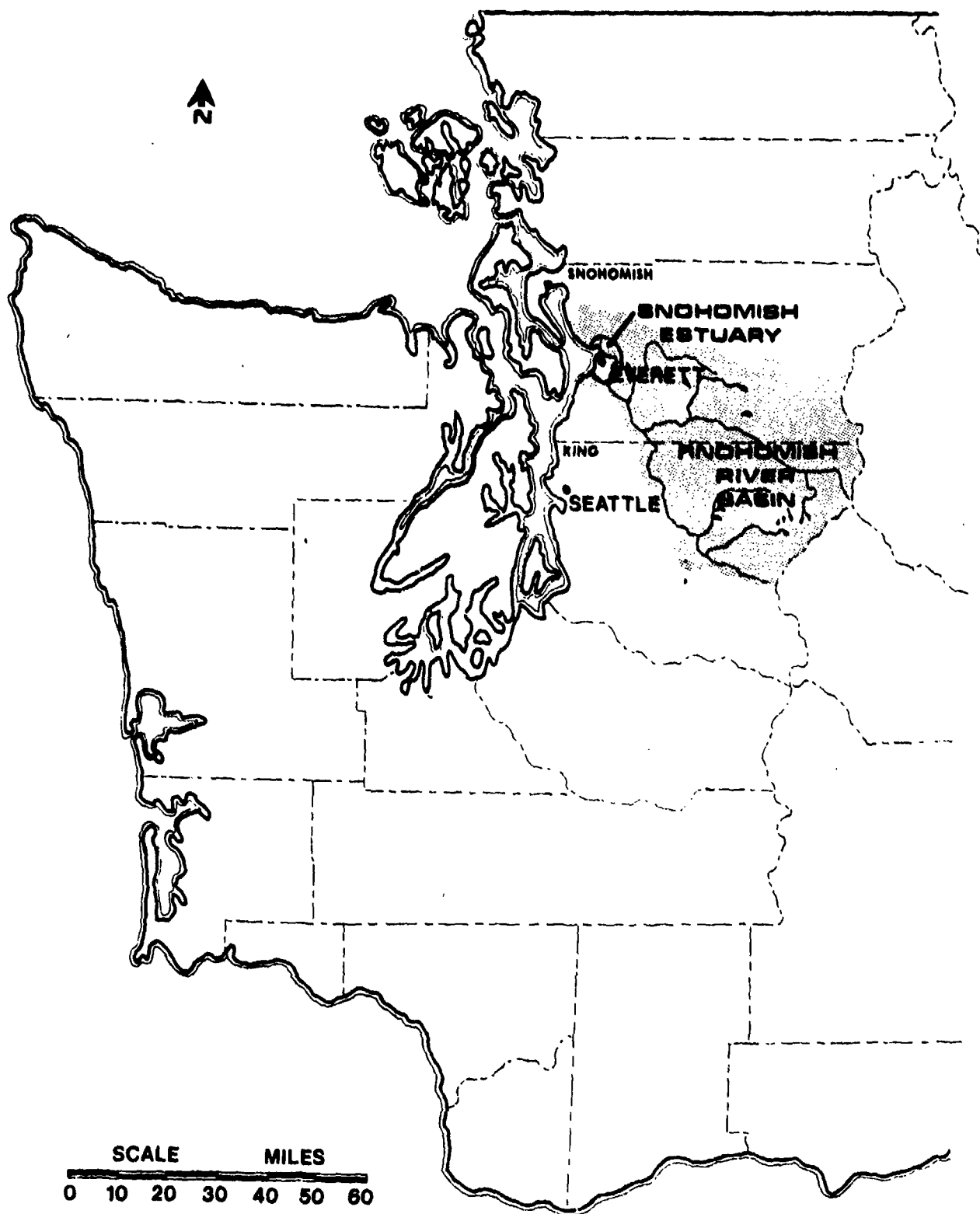
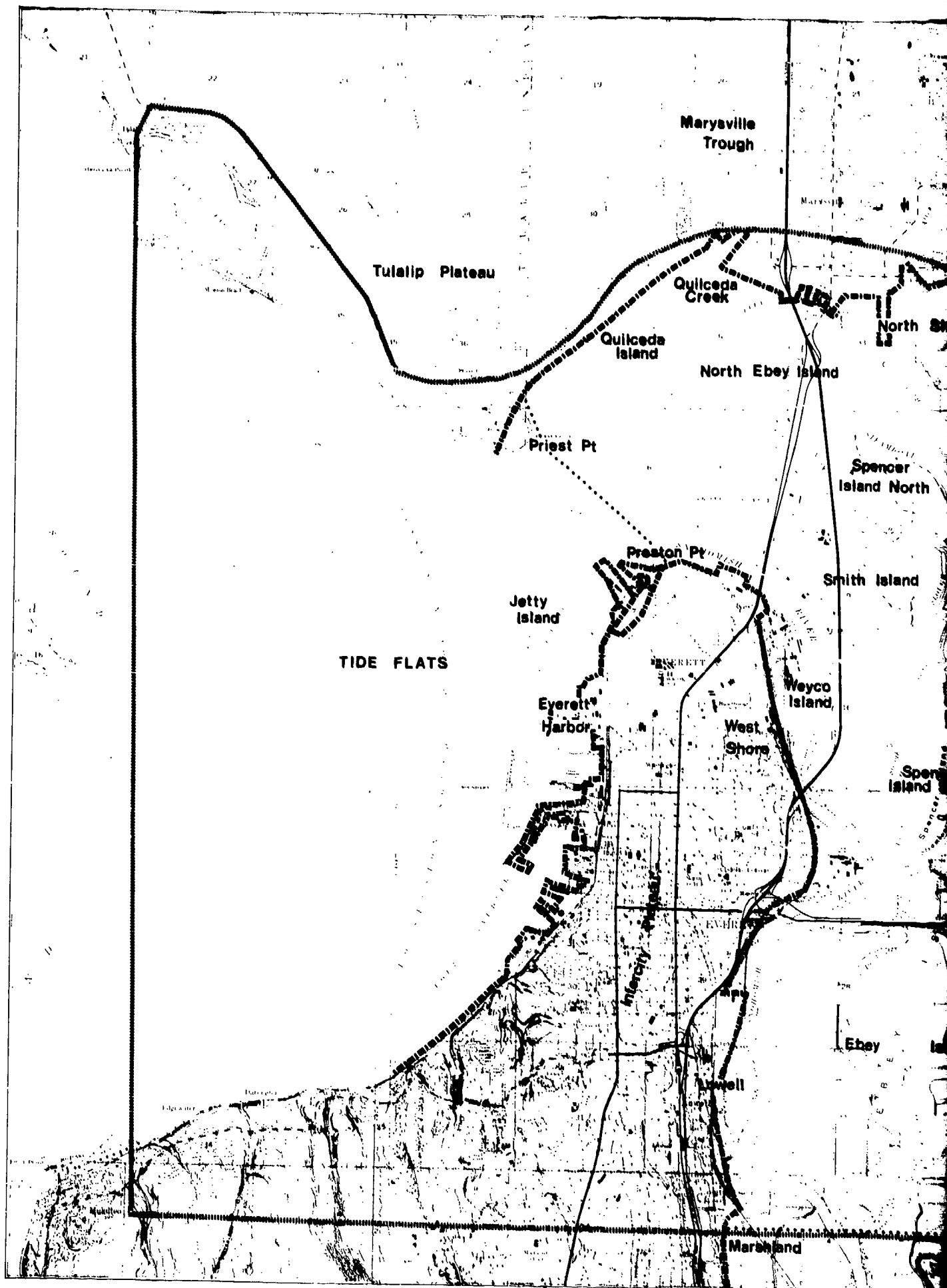
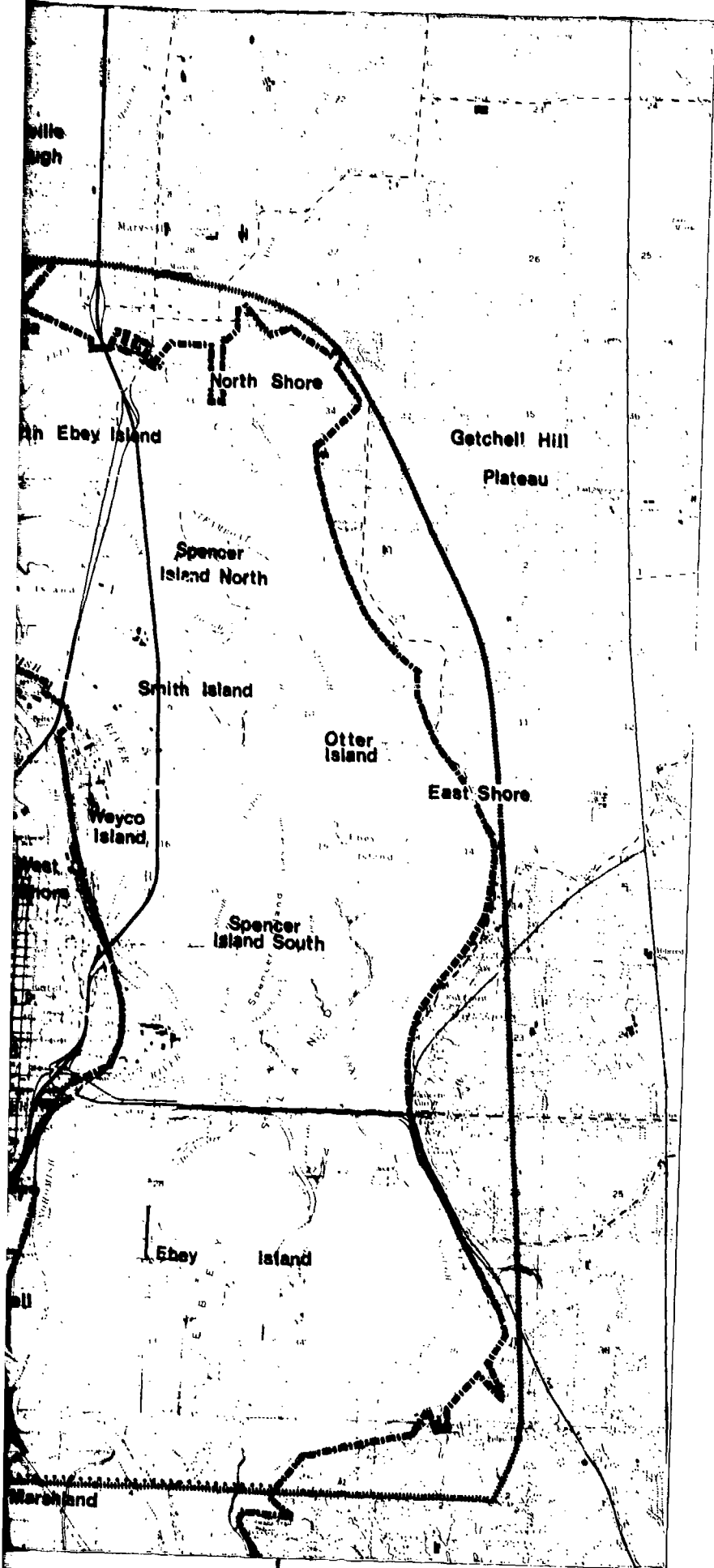


Figure III-1

LOCATION OF THE SNOHOMISH ESTUARY, WASHINGTON






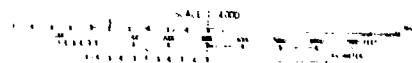


GEOGRAPHY

PLATE NO 1

LEGEND

-  SEWS Study Area
-  Approx Limits of 100 Year Floodplain
-  Land Use Study Area



SNOHOMISH ESTUARY WETLANDS STUDY

Source: Newcomb 1952
Corps 1973

HISTORY

5. The history of settlement in the Snohomish estuary began on 4 June 1792 when Captain George Vancouver landed on the beach at Port Gardner and ceremoniously claimed all the Puget Sound region for England. Since that time, the estuary and surrounding area have undergone extensive changes.

6. The Tulalip Reservation was created in 1855 by the Mukilteo Treaty. It has been suggested that the early development in the Snohomish estuary was inhibited by the proximity of the Reservation (Whitfield, 1926). For whatever reason, early settlement was centered around Snohomish City, located where the military road crossed the Snohomish River, rather than the river mouth.

7. Snohomish County was established in 1861 and the county seat located in Snohomish (City), where it remained until 1897. By that time the tremendous growth of Everett made it the choice for the county seat. The growth of Everett is reflected not only in its population figures, but also in the rate of industrial and agricultural development. Effects of this development boom at the turn of the century can be seen in the estuary today.

8. Construction of the Great Northern Railroad along Port Gardner and across the river mouth in 1891 was the first of many activities which would affect both Everett and the estuary. Besides connecting sparsely populated Everett to both Seattle and Marysville, the railroad tracks had several other impacts. A small pocket beach was isolated from Port Gardner, but remained tidally connected. This area later became known as Maulsby Swamp. Construction of railroad beds across Smith and North Ebey Islands also provided some initial fill to which an entire system of dikes was later attached.

9. The Everett and Monte Cristo Railroad was completed to Lowell in 1892 and shortly thereafter joined the Great Northern tracks near Preston Point. As with the Great Northern, these tracks had an impact on the estuary as well as on the city. The tracks ran near the southern end of Ebey Island; they were soon incorporated into a diking system which surrounded the entire island.

10. Construction of dikes in the estuary began as early as 1867 on the west end of Smith Island, though these early structures were unsuccessful. The map of 1884 shows approximately 100 acres of diked land in the estuary, most of it in a large parcel near the center of Spencer Island. In 1892 the county commissioners contracted for a dike around Ebey Island, thus forming Diking District No. 1. By 1895 diking was being carried out in the Marshland area. The 1895 and 1911 topographic maps of the study area show Smith, Spencer, Otter and North Ebey Islands, and most of the East Shore areas to be diked and drained. (Possible errors in these maps are

discussed in Methodology for Land Use Interpretation, Technical Appendix E.)

11. The final major development in the estuary was construction of a deepwater port and formation of the Port of Everett. The Port began as a riverside dock near the confluence of Steamboat Slough, where boats from both Seattle and Snohomish could land. With construction of the "Jetty" in about 1899, a protected harbor was created along the west side of Everett. It was not until a maintenance dredging program was established, however, that this entire port facility could be used. Prior to the dredging operation, the deepwater port was limited to several docks at the south end of Port Gardner. Fill placed for these docks was the first in a long series of such activities intended to create a major port and industrial location adjacent to the city of Everett.

12. Everett has always been primarily a timber-oriented city. This is apparent, not only from the numerous mills, but also from the vast expanses of log rafting facilities. Log rafts on mudflats in the port area, adjacent to the jetty and along the sloughs, date back to the early 1900's.

13. Thus, many of the patterns of development, and much of the development itself, were established in Everett's first 20 years. By 1910 all the railroads were built, most of the islands were diked, and the port was busy shipping timber to buyers throughout the world. From 1910 to 1940 the port expanded and new log rafting areas were located west of Smith and North Ebey Islands. In addition, the railroads filled more wetlands at Lowell and behind the Weyerhaeuser Mill to create switching yards.

14. After World War II the port and logging industries continued to expand, however, agriculture in the estuary began suffering setbacks. Dikes on North Ebey and Spencer Islands were breached and not repaired. Instead, some areas were "let go" to revert to wetlands. This happened to almost 500 acres in the estuary between 1947 and 1965. These reverted wetlands represent some of the most productive and valuable areas to the aquatic ecosystem in the Snohomish estuary today. Since 1965 there has again been a progressive loss of wetland habitat in the estuary. This new loss is the result of filling, primarily for industrial purposes. This is an irreversible process, which, unlike diking, prevents any recovery of the wetland area in the future.

CORPS JURISDICTION IN THE STUDY AREA

15. As described in Section 404 of the Federal Water Pollution Control Act Amendments of 1972, the Corps has regulatory authority

over the disposal of fill material in navigable waters and adjacent wetlands. "Wetlands" includes those areas that are "inundated or saturated by surface or groundwater at sufficient frequency and duration to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 323.2(c)). Adjacent wetlands have been defined to mean not only contiguous areas, but also those areas in a reasonable proximity but physically "separated by....man-made dikes or barriers, natural river berms, beach dunes and the like ..." (33 CFR 323.2(d)).

16. Section 67 of the Clean Water Act of 1977 (91 Stat. 1600; 33 U.S.C. 1344) is an amendment to Section 404 of the FWPCA: it affirms the authority of the Secretary of the Army, acting through the Chief of Engineers, to issue permits for the discharge of dredged or fill material into navigable waters. Section 67 specifies conditions for the issuance of general permits by the Secretary of the Army and establishes exemptions from the permit requirements. Section 67 also authorizes the development and administration of permit programs by the states to cover the discharge of dredged or fill material into the navigable waters (other than those waters which are presently used, or are susceptible to use in their natural condition or by reasonable improvement as a means to transport interstate or foreign commerce shoreward to their ordinary high water mark, including all waters which are subject to the ebb and flow of the tide shoreward to their mean higher high water mark on the west coast, including wetlands adjacent thereto). This section limits Corps 404 authority for permit issuance to Category 1 waters (33 CFR 323.329; FR 42, 138, 19 July 1977) in states with approved individual and general permit programs. Section 67 potentially removes tributaries and lakes greater than five acres in surface area, plus their adjacent wetlands, and all other waters of the United States from the Corps 404 permit program.

17. Delineation of the wetlands boundary as defined by Corps regulations (33 CFR 323.2(c)) was carried out as Component B of the Snohomish Estuary Wetlands Study. In this part of the study, aerial photographs and field verification were used to identify and map the extent of adjacent wetlands as defined by Corps regulations. The areas identified as adjacent wetlands have been the principal concern of this study. In evaluation of the biological importance of these areas, it is necessary to consider not only their physical and biological importance, but also the significance of activities surrounding them. Thus, the Snohomish Estuary Wetland Study has considered navigable waters and their adjacent wetlands as defined by 33 CFR 323.2(c) and those surrounding areas which might have a significant impact on navigable waters and their adjacent wetlands. The specific wetlands boundary line in the Snohomish estuary study area is shown on maps at a scale of 1:6000, available for review in the Seattle District offices. For further information see Boulé and Shea, 1978 (Volume IV).

Section IV

THE PERMIT PROCESS

Section IV

THE PERMIT PROCESS

1. Section IV discusses the process used by the Seattle District Corps of Engineers for review of permit applications. The flow chart in Figure IV-1 indicates the review process through which a permit application must go before a decision to issue or deny the permit is made by the District Engineer for the Seattle District. This process is taken from Corps regulations, 33 CFR 320-329 as implemented in the Seattle District.

2. Every permit application requires an environmental assessment and a finding of fact as part of the review process. If an environmental impact statement (EIS) is prepared, the draft EIS may serve as the environmental assessment.

3. A public notice is issued for every permit application. As shown in Figure IV-1, this public notice contains a description of the proposed work, a preliminary environmental assessment, and a statement of criteria for the decision to issue or deny the permit. The criterion for the evaluation of a permit application is whether the proposed activity is in the public interest, as shown by the following quote from Corps Public Notices issued in 1978:

The decision whether to issue a permit will be based on an evaluation of the probable impact of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered; among these are conservation, economics, aesthetics, general environmental concerns, historic values, fish and wildlife values, flood damage prevention, land use, navigation, recreation, water supply, water quality, energy needs, safety, food production, and, in general, the needs and welfare of the people. No permit will be granted unless its issuance is found to be in the public interest.

For permit applications under Section 404, the public notice also indicates how a request for a public hearing on the proposed activity may be made.

4. The public notice is routinely sent to over 150 federal, state, and local agencies, elected representatives, public and

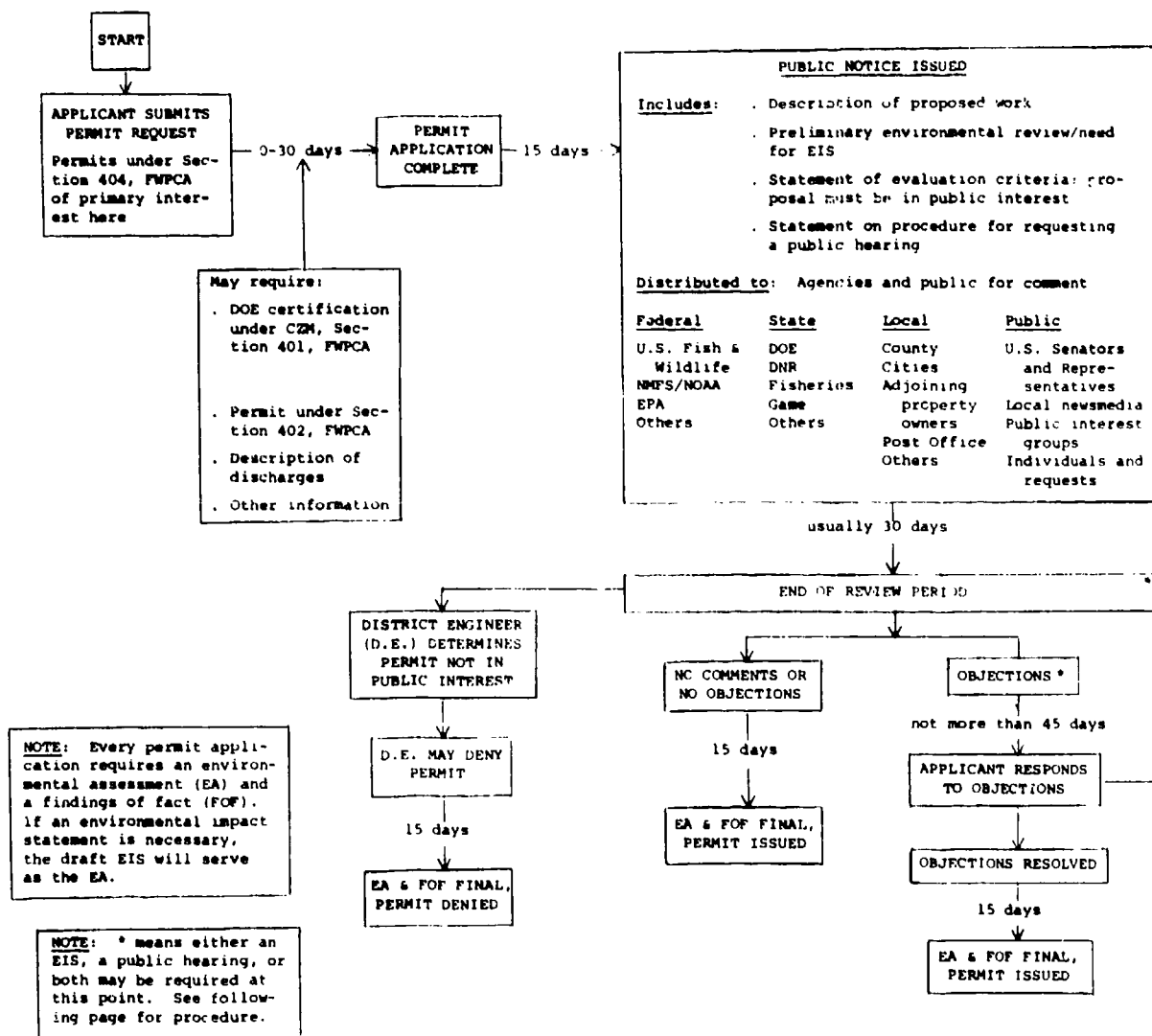
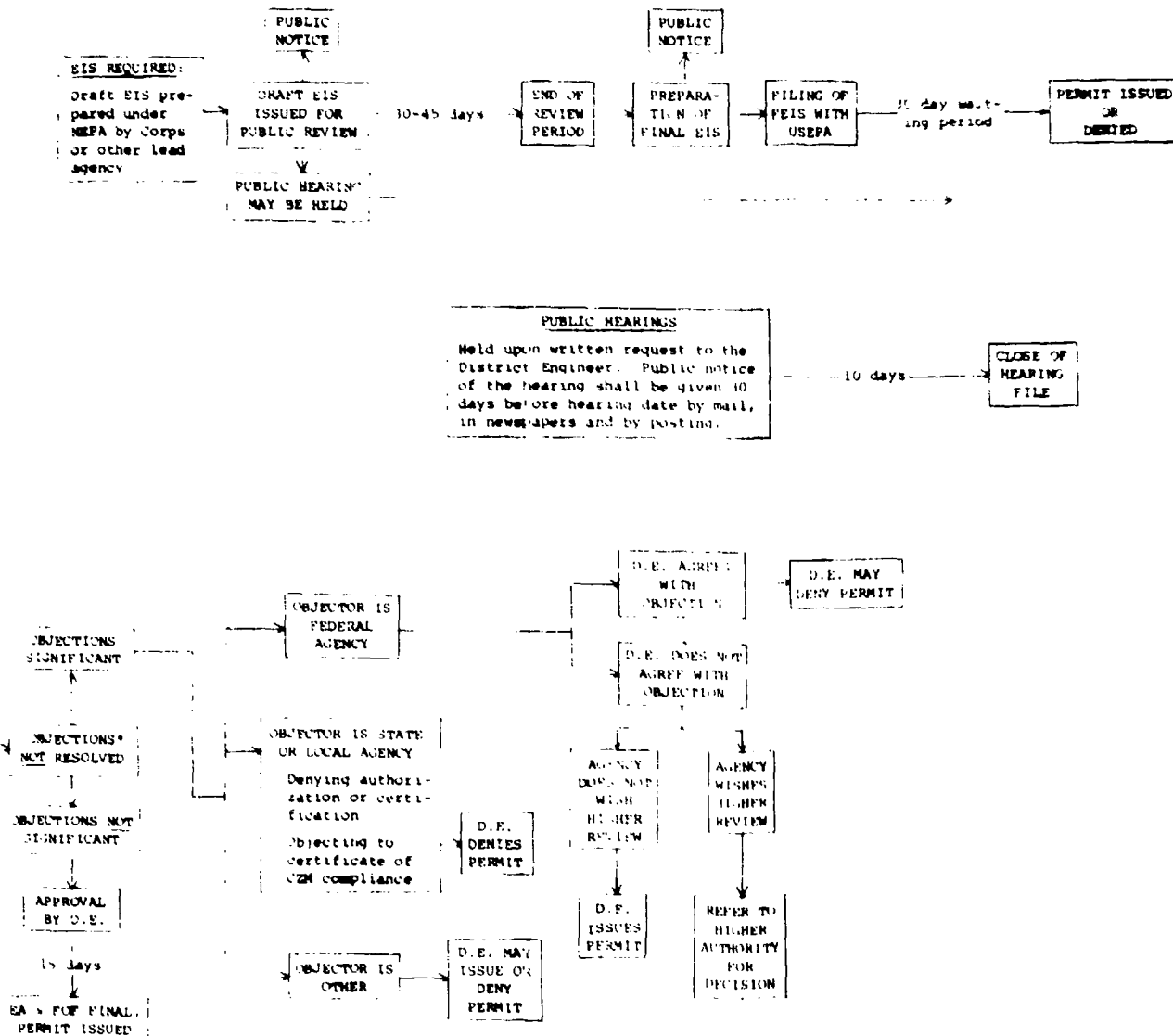


Figure IV-1

PERMIT PROCESSING PROCEDURE
Corps of Engineers, Seattle District
33 CFR 320-329



private interest groups, news media, and interested businesses and individuals. Owners of property adjacent to the proposed work are also notified. Any one may submit comments to the Corps on the proposed work or may request a public hearing.

5. As shown in Figure IV-1, there are several decision points for issuance or denial of a requested permit. If objections to the proposed work are raised during the public and agency review, the applicant is given opportunity to resolve these objections. If significant objections remain unresolved, then the District Engineer may issue or deny the permit or may refer it to a higher authority, depending on the nature of the objections.

6. The procedure depicted in Figure IV-1 insures that federal, state, and local agencies, and the public, have every opportunity for input to the Corps decision-making process. The solicitation of public and agency input is a means of identifying the public interest in the area and the probable impacts of the proposed work on that public interest. Section VII of Volume II contains a detailed discussion of the various agencies with authority in the study area and their stated policies for Corps permit application review. Thus, Section VII is a specific discussion of highlights of the expressed public interest in the Snohomish estuary study are

Section V

FINDINGS IN THE SNOHOMISH ESTUARY

Section V

FINDINGS IN THE SNOHOMISH ESTUARY

1. Section V presents the findings of the study in the Snohomish estuary study area. Section V.A. reiterates the importance of wetlands per Corps policy and EO 11990 and identifies and describes all wetlands by type in the study area. Section V.B discusses criteria for designation of Areas of Importance and Areas of Environmental Concern and the significance of such designation. The designated Areas are described in detail. Section V.C discusses the environmental impacts of various activities in the study area and presents a method for impact assessment (specific and cumulative) of proposed permit activities. Section V.D describes the factors influencing the location of development and evaluates development pressure on the various areas of the estuary.

2. Supporting data for the findings in Section V may be found in the Physical and Biological, and Public and Land Use Profiles, Sections VI and VII of Volume II, Snohomish Estuary Wetland Study. This section is cross-referenced to Sections VI and VII wherever possible. Sections VI and VII of Volume II are summarized in Section VI of the Summary Report (Volume I).

A. THE IMPORTANCE AND IDENTIFICATION OF WETLANDS

IMPORTANCE OF WETLANDS

1. As discussed in Section I (Introduction), the policy of the Chief of Engineers has expressed the view of wetlands as vital natural resources of importance to the people of this country. The regulations of the Corps of Engineers reiterate the importance of wetlands as follows:

Wetlands are vital areas that constitute a productive and valuable public resource, the unnecessary alteration or destruction of which should be discouraged as contrary to the public interest. 33 CFR 320.4(b)(1)

Executive Order (EO) 11990 emphasizes the importance of wetlands as critically important resources and directs federal agencies to preserve and enhance the natural and beneficial values of wetlands in management of federal lands, construction, and activities.

2. Under EO 11990 wetlands are broadly defined as areas which do (or would under normal conditions) support a prevalence of vegetative or aquatic life requiring saturated or seasonally saturated soil conditions (Section I). Areas specifically mentioned as wetlands in EO 11990 are swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mudflats, and natural ponds. The Corps definition of wetlands under Section 404, FWPCA, is more limited than the EO 11990 definition in that it is strictly based on vegetation. As a result, mudflats are not "wetlands" by Corps definition unless vegetated. Executive Order 11990 requires the protection of wetlands by federal agencies engaged in carrying out their responsibilities for federal lands, federal construction, and federal activities and programs. It is clear from these statements of national policy that all wetlands are to be considered important, and should be protected and preserved wherever feasible.

IDENTIFICATION OF WETLANDS

3. The first major aspect of the Snohomish Estuary Wetlands Study is the identification, description, and evaluation of all wetlands in the study area. All wetlands in the study area are classified and mapped as part of Volume III of the Snohomish Estuary Wetlands Study (Burrell, 1978). As described in the Biological Profile (Section VI), Volume III classifies study area lands, wetlands, and aquatic lands into seven different general habitat types: 1-Urban, 2-Agriculture, 3-Non-forested Vegetated Uplands, 4-Forested Uplands, 5-Water, 6-Aquatic Lands, and 7-Other Lands (vegetated spit).

Each class is subdivided to reflect more refined differences in habitat type; some classes are subdivided to a fourth level of refinement (for example 1-Urban, 15-Harbor/Port, 153-Log Storage, 1531-Log Yard and 1532-Log Raft).

4. Wetlands and associated aquatic resources fall under the water (5000 series) and aquatic lands (6000 series) habitat types. Water habitat types are rivers/streams, lakes/ponds, reservoirs, bays/estuaries, impoundments, lagoons, sloughs, canals/channels, and open water. Aquatic lands are those habitat types which are either intermittently covered by water or strongly influenced by adjacent waters. Aquatic lands are divided into the following categories:

- 6 Aquatic Lands
 - 61 Forested
 - 611 Intertidal Freshwater/Brackish Swamp
 - 6111 with Picea
 - 6112 without Picea
 - 612 Freshwater Swamp
 - 6121 with Picea
 - 6122 without Picea
 - 62 Vegetated-Non-Forested
 - 621 Kelp Community
 - 6211 Sparse Nereocystis
 - 6212 Dense Nereocystis
 - 622 Other Algal Associations
 - 6221 Ulvoids
 - 6222 Laminarian
 - 6223 Fucoid
 - 623 Eelgrass (Zostera sp.)
 - 624 Salt Marsh
 - 6241-6247 Various vegetative associations including Carex, Triglochin, Potentilla, Agrostis, Deschampsia, Scirpus, Salicornia.
 - 625 Brackish/Freshwater Intertidal Marsh
 - 6251 Scirpus
 - 6252 Scirpus-Typha
 - 6253 Typha
 - 6254 Carex
 - 626 Freshwater Marsh
 - 6261 Scirpus
 - 6262 Typha
 - 6263 Scirpus-Typha
 - 6264 Juncus depression/pasture
 - 63 Non-vegetated
 - 631 Rock
 - 632 Cobble
 - 633 Mixed Coarse
 - 634 Mixed Medium

635 Mixed Fine
636 Sand
637 Sand-Silt
638 Mud

5. In the Snohomish estuary study area, all wetlands as defined by Corps regulation 33 CFR 323.2(c) are contained in the aquatic land (6000) habitat type. Aquatic lands-nonvegetated (63 class) are not wetlands by Corps definition. However, as emphasized in the broader definition of wetlands in EO 11990, nonvegetated aquatic lands are vital natural resources that should be preserved and protected.

6. Volume IV of the Snohomish Estuary Wetlands Study (see Section III) delineates the boundary of tidal wetlands in the Snohomish estuary study area. Certain of the wetland types classified in the aquatic lands (6000) series may not lie under Corps jurisdiction as defined in 33 CFR 323. Aquatic lands (wetlands) type 612 freshwater swamp (with or without *Picea*) and type 626 freshwater marsh are not tidal wetlands and Corps jurisdiction may not include all such wetlands.

7. Because of the importance of all wetlands, a detailed description of wetlands by type is included in this section. Each wetland type is described in the format shown in Template 1 (attached). The template title is either Wetland Type (for the aquatic lands 6000 series) or Water (for the water 5000 series). The wetlands (aquatic lands) series is discussed at the third (600) level of detail, except where differences at the fourth level were judged to be biologically significant. The water series is presented as a single discussion. As shown in Template 1, a general description of wetland types and the distribution of that type in the study area is given. Detailed maps of the estuary study area at a scale of 1:6000 are on file at the Corps of Engineers Seattle District office; these maps show the distribution of all wetlands and water (and other habitat classes) in the study area. (These maps were not reproduced in this document because significant information would be obscured in the reduction.) The history of alterations of each type is briefly discussed. The templates also describe the significant relationships and functional importance of each wetland type; these descriptions represent a summary and synthesis of material presented in the Physical and Biological Profiles.

8. Two important historical aspects of the habitat types are referred to in the template discussions, but are not explained in detail therein. These are succession, and the effects of dikes and breached dikes. A short discussion of these aspects follows.

Succession

9. Succession is the process of plant community evolution. A bare substrate is colonized by pioneer plants tolerant to the sun-light, nutrients, periodic inundation, soil saturation, soil salinity and other conditions present. Pioneer plants alter these conditions through deposition of organic material, entrapment of sediment, formation of shade, and other changes. This alteration is usually in the direction of a less stressful condition, thereby creating an environment conducive to more and different species. Each step in the process of environmental change occurs for years and sometimes centuries. The question of the existence of a final stage, or climax, has been debated for many years and is not yet resolved.

10. In wetland habitats, the primary condition which changes through successional stage appears to be elevation, and the consequent frequency and duration of inundation. If this is the case, then the salt marsh pioneers in the Snohomish estuary are pickleweed and sedge. These are both relatively low elevation species. As the substrate elevation rises, arrowgrass, bent grass, and silverweed become established and the sedge is lost. At the upper elevation of the salt marsh all of these species are crowded out by a very dense, monotypic bulrush community.

11. The successional relationships of the intertidal brackish/freshwater marshes suggest the mixed cattail/bulrush community is the pioneer community. Invasion by spiraea, rose and other shrubs, eventually converts the area to a shrub swamp. Finally, with continued deposition of material, alder and spruce may become established, resulting in a forested swamp. This description of succession in the Snohomish estuary is based strictly on observation; research is needed to verify and refine the understanding of the process.

Dikes and Breached Dikes

12. In diked areas several different situations have occurred. In areas where dikes have been maintained but the land not cleared, freshwater swamps (612 type) are often present. If the dikes have been maintained, and the land cleared, the land is presently agriculture or perhaps non-forested vegetated upland. In some areas dikes were built, the land cleared and then the dikes breached, allowing the site to revert to wetlands. These areas are presently vegetated with brackish intertidal marsh (625 type) and some appear to be undergoing succession to shrub swamp (6112 type). Finally, Sunnyside Swamp (see Section V.B) is an example of an area where dikes were constructed, but the land was not cleared. When the dikes were breached, the area reverted to its original intertidal state with no apparent significant change in habitat.

Template 1 (Sample format)

WETLAND TYPE

TYPE: Number and Name

DESCRIPTION: General description; that is, flora, substrate, inundation characteristics, etc. Indication of any subcategories under the third level, any significant differences between subcategories and whether the subcategories should be discussed separately.

DISTRIBUTION: Total acreage of this type in the estuary by subcategory and by overall category (level 3). Distribution of type by island. Distribution by parcel size; general numbers of parcels large and small.

HISTORY IN ESTUARY: Evidence of logging, dike/fill, dike breaching.

SIGNIFICANT RELATIONSHIPS AND FUNCTIONAL IMPORTANCE:

- A. Plant diversity, and successional stages.
- B. Fauna; feeding, nesting, resting. Mammals, birds and waterfowl, fish, shellfish and other invertebrates.
- C. Productivity, nutrient cycles, food web.

WETLAND TYPE

WETLAND: 611 Intertidal Freshwater/Brackish Swamp

Description

This is a shrubby or forested area in which the tidal fluctuation results in inundation and/or water table fluctuation. Although the frequency and duration of tidal inundation are not known, the boggy soil and fluctuating water level in shallow depressions are strong evidence of tidal influence. The vegetation in these areas is of three major types: Coniferous trees, broadleaf deciduous trees, and shrubs. The coniferous trees are predominantly Sitka Spruce (Picea sitchensis), although red cedar (Thuja plicata) may also be found. Broadleaf deciduous trees found in the swamp include alder (Alnus rubra) and several species of willow (Salix spp.). Wild rose (Rosa pisocarpa), Nootka rose (R. nutkana), honeysuckle (Lonicera involucrata), Ninebark (Physocalpus capitatus) and Spiraea (Spiraea douglasii) are the most common shrubs found in the swamp habitat. Cattail (Typha sp.) and Goldenrod (Solidago sp.) may also be associated with swamp habitats. The habitat type has been subdivided according to the presence (6111) or absence (6112) of Sitka Spruce.

Distribution

There are about 300 acres of intertidal spruce swamp (6111) within the estuary study area. The largest parcel is 82 acres on Otter Island. Parcels at Quilceda Creek, the south end of North Ebey Island, Sunnyside Swamp and Cavalero Corner vary from 17 to 47 acres. These five locations represent more than 70% of this habitat type in the estuary. The remainder is scattered throughout the estuary, either as a narrow band between dike and slough, or in small parcels usually less than five acres in size.

The intertidal swamp without spruce (7112) encompasses 226 acres in the estuary. Almost one-half of this acreage is located on Ebey Island, including 42 acres at the Highway 2 location. The remaining acreage of this type in the estuary is divided into numerous parcels varying from one (1) to ten (10) acres. Many of these are narrow slough-side habitats located between the slough and the dike.

History

An old topographic map of the estuary (USGS, 1884) suggests the entire floodplain was originally wetland, with a high density of trees in areas such as Otter Island, the east shore of Ebey Slough, the west

shore of the main channel and most of Ebey Island. This represents approximately 4,000 acres of swamp. Since 1884 almost all of Ebey Island and the east shore of Ebey Slough have been diked and much of the land cleared for agricultural uses. (The Sunnyside Swamp and approximately 500 acres owned by the Washington Department of Game were diked, but apparently never cleared). Much of the west shore of the river has been filled for industrial activity. Thus, of the approximately 4,000 acres of intertidal swamp in the estuary, only about 525 acres remain. In addition, there are approximately 640 acres of freshwater swamp which have been diked, and therefore removed from hydraulic interaction with the estuarine ecosystem.

Significant Relationships

The swamp habitat type is a diverse plant community with a wide variety of shrubs and trees. The shrub swamp (6112) appears to be the successional stage which follows the cattail marsh (6253) and precedes the spruce swamp (6111).

The swamp habitat type supports a wide variety of fauna. Insects are abundant in the boggy, densely vegetated community. These insects are an important food source to small songbirds such as wrens and chickadees. Insects are also an important food source to woodpeckers, which depend on snags for feeding grounds. A wide variety of small rodents, such as mice and moles, are common on the ground and in the low branches of swamps. These small mammals and birds are preyed on by larger mammals such as muskrat, mink and raccoon. These larger mammals often nest in dens or hollow logs within the swamp. Deer may also browse in swamps, especially forested swamps with a somewhat less dense understory. Raptors often nest in coniferous trees and also rest there when not hunting.

The swamp habitat type is highly productive, generating abundant detritus. However, since the swamp has a relatively high tidal elevation, much of this detritus is deposited as forest litter, rather than being exported into the aquatic ecosystem. As a habitat for a wide variety of birds and mammals the swamp is an important part of the food web which constitutes the estuarine ecosystem.

WETLAND TYPE

WETLAND: 612 Freshwater Swamp

Description

These shrubby or forested areas are characterized by saturated soils and some open water (at least seasonally). They are low areas, but are not inundated by tidal water; in most cases they are protected by dikes. The vegetation in these areas is of three major types: Coniferous trees, broadleaf deciduous trees, and shrubs. The coniferous trees are Sitka Spruce (Picea sitchensis), western red cedar (Thuja plicata) and lodgepole pine (Pinus contorta). The deciduous trees are willow (Salix spp.) and alder (Alnus rubra). Common shrub species include: ninebark (Physocarpus capitatus), swamp dogwood (Cornus stolonifera) and honeysuckle (Lonicera involucrata). The habitat type has been divided according to the presence (6121 habitat type) or absence (6122 habitat type) of spruce.

Distribution

There are approximately 640 acres of freshwater swamp in the estuary, of which 580 is spruce swamp (6121 habitat type). The largest single parcel is the 430 acres in the Washington Department of Game land on Ebey Island. There is another 150 acres in three moderate and several small parcels on Ebey Island.

Only 50 acres of freshwater shrub swamp (6122 habitat type) have been identified in the estuary. This is distributed as several small parcels on Ebey Island and the east shore of Ebey Slough.

History

The freshwater swamp probably represents a wetland which has been diked, but never cleared. The area was sufficiently low that it did not drain and as a result it maintains its wetland characteristics. Ebey Island was probably diked before 1900 and the east shore of Ebey Slough between 1911 and 1940; the dikes have been maintained ever since.

Significant Relationships

Freshwater swamps (612) have many species and functions in common with intertidal brackish/freshwater swamps (611). The only apparent differences between the two habitat types are the presence of lodgepole pine and absence of tidal connection in freshwater swamps.

Freshwater shrub swamps (6122) appear to represent a successional stage which follows freshwater cattail marsh (6262) and precedes freshwater spruce swamp (6121).

Freshwater swamps provide nesting, feeding and resting habitat for a great variety of wildlife. Woodpeckers, wood ducks and ruffed grouse will all feed and nest in wooded swamps. Insectivorous birds such as wrens and chickadees are usually common. Eagles, hawks and owls may all nest in the dense forest, feeding there or in nearby fields, streams or marshes. Deer, and small mammals such as mink, raccoons, squirrels and muskrat are commonly found in swamps.

As with intertidal swamps, freshwater swamps are highly productive; they generate extensive quantities of detritus from leaves and branches. Since there is no aquatic connection, however, even less of this detritus is exported to the estuary ecosystem than in the intertidal situation. The primary function of freshwater swamps within the estuary appears to be to provide a habitat for a wide variety of mammals and birds.

WETLAND TYPE

WETLAND: 623 Eelgrass

Description

Eelgrass is a rooted plant found in the lower intertidal and shallow subtidal zones of marine habitats. It often forms large dense beds on muddy sand flats. The abundant rhizomes and roots of eelgrass often form thick mats which resist erosion, thus stabilizing the substrate.

Distribution

Extensive eelgrass beds are found on the shallow mudflats at the mouth of the Snohomish River. These flats extend westward to Tulalip Bay and south to the south end of Jetty Island. More than 40% of the 3,000+ acres of flats in this area are vegetated with eelgrass. In addition, there are eelgrass beds in Tulalip Bay, although they are not extensive.

History

No historic data exists on the distribution of the flats or the associated eelgrass beds in the study area. An 1884 chart indicates that approximately 200 acres of flat was exposed at low water west of North Ebey Island. This chart does not display any other bathymetry data in the area. An engineer's report in 1892 indicates that tideflats extend 2.5 miles south from the mouth of the Snohomish along Port Gardner*(Wellman, 1932). Creation of the jetty and disposal of dredged material seaward of the jetty has probably affected the size and distribution of the flats; a new route and deposition process has been created for the riverborne sediment. There is no data to indicate the extent of this alteration.

Significant Relationships

Eelgrass provides food, shelter, and substrate for a diverse population of organisms. Numerous species of algae, bacteria, and invertebrates reside on eelgrass blades. Many of these in turn are food for the fish and crabs which inhabit the beds. The dense vegetation and thick root mass provide shelter for fish and benthic organisms. An important resident of this habitat is the Dungeness Crab (Cancer magister). All of these in turn are food for a diversity of larger fish, waterfowl and occasional raptors. Shellfish, including cockles and some clams, are found in eelgrass beds. Detrital material, the remains of dead plants such as eelgrass, are known to be food for a variety of filter feeding organisms, including many which are residents of unvegetated flats. Eelgrass beds are also important spawning and rearing grounds for herring.

*Publications referenced in this summary report are located in Appendix F, Volume II.

WETLAND TYPE

WETLAND: 624 Salt Marsh

Description

These are communities of intertidal vascular plants which are capable of withstanding daily inundation with marine waters. The frequency and duration of inundation are a function of elevation and the various communities tend to segregate according to elevation. Thus, there is a plant community zonation within the marsh with respect to elevation. This phenomenon has been reported in the Snohomish estuary (Volume III, SEWS) and elsewhere in the Northwest (Eilers, 1975; Disraeli, 1977).

Seven communities have been identified along an elevational gradient in the Snohomish estuary. The lowest is a Pickleweed community (*Salicornia virginica*). Above this are several sedge communities, each with a different composition of associated plant species. The uppermost salt marsh community is often a monotypic community of bulrush (*Scirpus* spp.) (Volume III, SEWS)

Distribution

There are approximately 430 acres of salt marsh in the study area. About 170 acres is located on North Ebey Island, west and south of the landfill. There are 145 acres of salt marsh between Priest Point and I-5, with 90% in the Quilceda Creek area. Finally, there is about 80 acres of salt marsh along the west end of Smith Island. The remaining salt marsh areas are scattered small parcels on Spencer Island, Jetty Island and Tulalip Bay.

History

The distribution of salt marshes within the estuary prior to development is not known. Salinity data (see Hydrology) and the present extent of salt marsh habitat types suggests that salt marshes did not extend much farther upstream than the present location of the Great Northern Railroad. Assuming this to be the case, and assuming the entire floodplain was wetland (as indicated in the 1884 chart) then there were approximately 1,000 acres of salt marsh at the mouth of the Snohomish River in 1884. At present there are about 400 acres in the area, suggesting a reduction by about 60%.

Two activities are responsible for most of the elimination of salt marsh habitat types in the estuary. The first is the diking of Smith

Island before 1911. This removed approximately 300 acres of wetland from the system west of the railroad tracks. The second is the North Ebey Island landfill. This site has covered approximately 130 acres of tidal wetland between 1965 and 1978.

Significant Relationships

Salt marshes are composed of a variety of communities; some of these communities are monotypic, and some are extremely diverse. The successional sequence appears to begin with the low elevation, monotypic pickleweed and sedge communities. The moderate elevation communities are much more diverse. The uppermost community, however, appears to be a monotypic bulrush community. Further research is necessary to establish the exact elevational and successional relationships of these habitat types.

Salt marshes provide a feeding habitat for a variety of birds and mammals. Seeds of marsh plants (e.g. sedge) are a food source to waterfowl, especially dabbling ducks. Songbirds such as sparrows, and small mammals also feed on marsh plants when the tide is low. Insectivorous birds such as swallows, wrens and tits are often observed to feed on the numerous insects associated with marsh habitats. These small birds and mammals in turn provide prey for the raptors (especially hawks) and carnivorous mammals (mink, raccoon, muskrat) which often enter marsh areas.

In addition to feeding, numerous birds use the marsh for nesting and resting. Some waterfowl may nest in the salt marsh, and many take shelter there during moulting. Rails, bitterns and some wrens breed in the high marsh; they build their nests above the high water mark or hang them from the vegetation.

Salt marshes are highly productive habitat types which, due to frequent tidal inundation, export much of that productivity as detritus into the aquatic system. This detrital material in turn is a major food source for the abundant detritivores that occupy nearby mudflats.

WETLAND TYPE

WETLAND: 625 Brackish/Freshwater Intertidal Marsh

Description

These are vegetated intertidal areas which receive regular brackish or freshwater inundation. Almost 90% of this habitat type is represented by a mixed cattail/bulrush community (6252 habitat type). The remainder is either monotypic cattail (6253 type), monotypic sedge (6254 type) or an undefined mix (6250).

Distribution

Of approximately 720 acres of this habitat type in the estuary about 270 acres are located on North Ebey Island east of I-5. Another 120 acres are scattered as small parcels west of I-5 on Ebey Island. There are about 105 acres of this habitat type in the Quilceda Creek area, with about 95% east of the creek. There are 65 acres of mixed cattail/bulrush (6252) habitat type on Otter Island and 56 acres on mid-Spencer Island, 12 acres to the south and 44 acres to the north. The remainder of this habitat type is scattered throughout the estuary in numerous small parcels of one to 20 acres. Many of these are narrow bands of sedge marsh along the slough edge.

History

There is no information concerning distribution of this habitat type prior to development of the estuary. An 1884 map of the estuary does indicate, however, that almost all of the floodplain was wetland prior to its development. If this was an accurate analysis of the estuary, then wetlands have decreased from approximately 12,000 acres in 1884 to some 1,800 acres in 1977 (see Land Use Profile). This represents elimination of approximately 85% of the wetlands, primarily through diking.

Significant Relationships

This is a low diversity habitat type which is characterized by a dominance of only one or two species. The cattail marsh appears to be an early successional stage preceding the shrub swamp. There is no information to suggest the successional relationships of the sedge marsh or the mixed cattail/bulrush marsh.

The sedge marsh is an important feeding habitat for waterfowl; the sedge is eaten by numerous dabbling ducks. Its low elevation along

the slough makes it a popular feeding area which is easily reached from the water at most stages of the tide.

Cattails and bulrushes are an important feeding and breeding habitat for a wide variety of fauna in the estuary. Many small rodents nest on the floor of the marsh and feed on insects, seeds and vegetation. Small songbirds also feed on insects; their nests are often attached to a clump of reeds. Rails and bitterns are also common residents in this habitat type, although due to their shy manner they are rarely seen. Larger rodents, such as beaver and muskrat, also feed in these marshes (the only known beaver dam in the estuary is in a cattail marsh near Lowell). Evidence of deer has been seen near marsh-swamp borders, indicating use of the habitat as a resting area. With the abundance of small mammals and birds, numerous predators find the marsh an important feeding ground. Raptors, mink, and raccoons all enter the marsh to hunt.

The low diversity brackish marshes have an extremely high rate of productivity. In addition, the relatively low tidal elevation and consequently high aquatic interaction means a significant percentage of this material is exported as detritus, adding to the food base of an important aquatic food web. These marshes also aid in the regulation of nutrients and contaminants in the estuary through the deposition of suspended solids. Nutrients, such as phosphorous and nitrogen, and assorted contaminants which adhere onto these suspended solids before deposition, are absorbed by the vegetation, trapped in the sediment or slowly broken down by microbial action.

WETLAND TYPE

WETLAND: 626 Freshwater Marsh

Description

These are low, wet areas which do not receive any tidal inundation. They are characterized by cattails, bulrushes or rushes. Often rushes will dominate in a marsh which is being grazed. Subdivisions are defined according to dominant species, such as bulrushes (6261), cattails (6262), cattail/bulrush (6263), and rush (6264).

Distribution

Only 83 acres of freshwater marsh have been identified in the estuary. The largest single parcel is a 10-acre marsh located between the Weyerhaeuser Mill and the Great Northern Rail Yard in northeast Everett. Elsewhere, fresh marshes are common in sloughs which have been dammed or equipped with tide gates, preventing the influx of tidal water.

History

The marsh behind the Weyerhaeuser Mill was probably once a tidal marsh. Construction of the mill between 1911 and 1940 probably resulted in the isolation of that marsh from tidal influence. In other locations streams or small sloughs (such as the one bisecting Smith Island) were dammed. These low areas remain wet and support freshwater marshes.

Significant Relationships

Freshwater marshes are often low in diversity but high in productivity. They do not export much of this productivity, however, since they have little or no hydraulic connection with the estuary. The successional relationships appear to be the same as for intertidal freshwater/brackish marshes. That is freshwater marshes develop into freshwater shrub swamps, which in turn succeed to spruce swamps. As with other successional relationships in the Snohomish estuary, further research is needed to adequately describe the process.

Freshwater swamps provide resting and feeding habitat for waterfowl, especially where they are associated with open water. Shorebirds, such as rails and bitterns, and songbirds, such as red-wing blackbirds and wrens, use the freshwater marsh as both feeding and nesting habitat.

Where freshwater marshes are associated with riparian habitat, numerous upland birds and mammals will use the marsh. Rodents and small songbirds will feed in the fresh marsh. Carnivorous mammals such as minks and raccoons will prey on the smaller animals. Hawks and other raptors will feed on these small animals also.

As mentioned above, freshwater marshes are usually highly productive. However, as with other aquatic lands which are not strongly connected with the estuary, they export little to the aquatic ecosystem. The primary function of these wetlands appears to be as a habitat for a wide variety of organisms. Nonetheless, movement of those organisms into the estuary represents export of some productivity and a contribution to the food web.

WETLAND TYPE

WETLAND: 637 Muddy Sand Substrate
638 Mud Substrate

Description

These two unvegetated substrates are found throughout much of the flats which extend from the Snohomish River mouth to Tulalip Bay and the southern end of Jetty Island. The substrate is mud or a silt and sand mixture which contains an abundant biological community, including benthic diatoms.

Distribution

In addition to the flats extending into Port Gardner, mud and silty sand substrates are found along the east side of the Port of Everett and through much of Tulalip Bay. Small parcels of this habitat type have been identified along Quilceda Creek and in the area between the landfill and the railroad tracks on North Ebey Island.

History

Although the distribution of these flats has not been recorded historically, they have probably been accreting westward for centuries. River-borne sediments and materials eroded from both the Everett and Mission Beach Bluffs have been deposited in this area, slowly extending the flats outward from the estuary. With construction of the jetty and settling basin the deposition of river-borne sediments has been diverted somewhat but not halted.

The major impacts on these unvegetated flats have been filling and log rafting. Filling raises the substrate surface out of the marine environment, thus eliminating it from direct interaction and making it available for development. This has occurred in several locations within the Port of Everett. Log storage restricts access by waterfowl which would use the shallow flats for feeding. It also results in the deposition of large quantities of bark and wood chips. This material generates a significant biochemical oxygen demand and eliminates much of the potential habitat value for benthic organisms. Additionally, log rafting shades the substrate, thus potentially impacting benthic diatoms. The shallow flats west of Smith Island and North Ebey Island along the east portion of the Port of Everett and in much of Tulalip Bay have traditionally been used for log storage activities.

Significant Relationships

Mud and sand flats in the Snohomish River mouth have been shown to be

highly productive habitats for benthic invertebrates and plankton (Smith, 1977). These bottom dwelling organisms feed on detritus washed out of marshes and eelgrass beds, and on each other. They in turn provide food for waterfowl and a variety of fish, such as salmon and flatfish. Shallow sand and mud flats have been noted as having some of the highest fish densities of all nearshore fish habitats (Miller, et. al, 1976). In part this high density results from use of the areas by schooling juvenile salmon, herring and smelt. This activity makes these shallows extremely important to the later commercial and sport harvest of these species.

In addition to fish, invertebrates and waterfowl, mud and sand flats are important habitats for shellfish. Bent-nosed clams, soft-shell clams, horse mussel, cockles and littleneck clams are all commonly associated with these habitats.

WATER

TYPE: 5 Water

Description

This habitat type includes a wide variety of water bodies within the study area. The estuarine river channels and small streams, inland ponds and lakes, and the open waters of Possession Sound are part of this habitat type. Salinity varies from the marine waters of Possession Sound to freshwater lakes and streams. Water is the medium which transports detritus from wetland and upland habitat types to intertidal and subtidal areas. Phytoplankton are the primary producers of the water habitat, and the basis of a grazing food web which includes zooplankton, crabs, salmon, and other aquatic fauna.

Distribution

There are about 2,000 acres of water within the land use study area of which 1,530 acres represent the main channel and adjacent sloughs, and 370 acres represent open water at the river mouth. In addition, there are 80 acres of old sloughs which have been cut off as a result of diking activities. The remaining acreage represents several small inland ponds.

History

Prior to the diking and channelization activities all of the sloughs were tidally influenced and numerous small creeks emptied directly into the estuary. During the late 1800's Steamboat Slough was the main channel of the estuary system, as evidenced by use of the channel for steamboat navigation upriver and reports that the bottom of the old channel (now main channel) was often exposed at low tide. After completion of the Jetty in 1895, the main channel was dredged for navigation purposes. Since then the main channel has been maintained for navigation. The channels have also been used for log rafting for many years. Since completion of the diking, many of the creeks empty into the estuary through tide gates.

Significant Relationships

Water is not only the habitat for fish, shellfish, and plankton, it also provides resting and feeding habitat for waterfowl, wading birds and a few upland mammals such as beaver, muskrat and otter. Water is the transport medium of detritus, carrying it from the wetland habitat types to the intertidal flats and beyond.

Water is also used to dilute and dissipate municipal and industrial wastes. Materials which are discharged into the estuary are meant to be transported out of the river and into Possession Sound.

B. AREAS OF IMPORTANCE AND AREAS OF ENVIRONMENTAL CONCERN

1. The second major finding of the Snohomish Estuary Wetlands Study is a designation of certain areas in the study area as Areas of Importance or Areas of Environmental Concern. The following discussion presents the significance of the designation, the criteria by which designations were made, and a detailed description of each designated area. Plate 2 shows these areas. A matrix (Figure V-1, p. 60) shows which criteria are met by each area in a summary form.

SIGNIFICANCE OF THE DESIGNATION

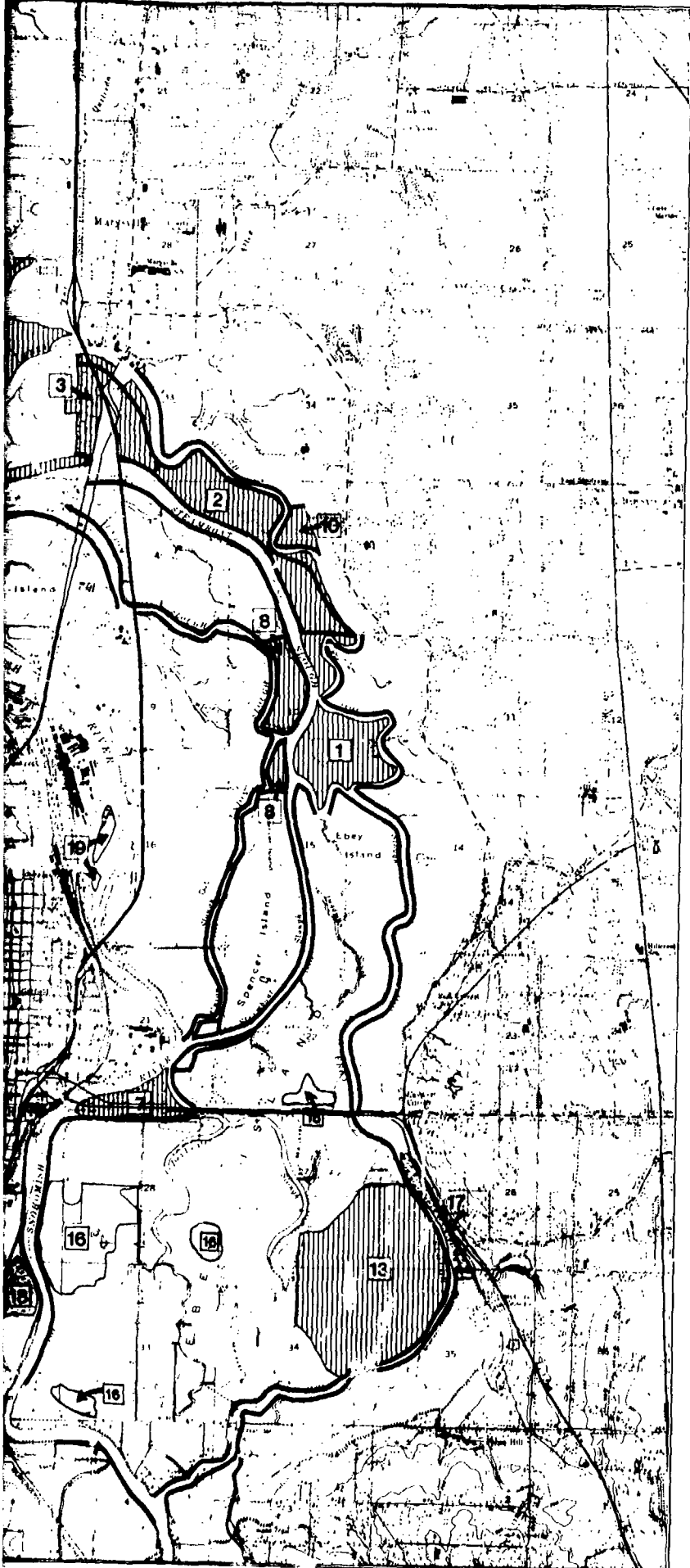
2. Areas of Importance are those areas of such importance and/or uniqueness to the functioning of the Snohomish estuary ecosystem and its aquatic resources that potential destruction or alteration would be discouraged unless it was found to be in the best public interest. Therefore, permit applications in Areas of Importance will require intensive review to determine (1) whether the public interest requires the issuance of the requested permit; (2) whether the benefits of the proposed alteration outweigh the damage to the estuarine resource; and (3) the proposed work is necessary to realize these benefits. According to Corps regulations, 33 CFR 320.4(a)(1):

"The decision whether to issue a permit will be based on an evaluation of the probable impact of the proposed activity and its intended use on the public interest....That decision [whether to authorize a proposal and any necessary conditions] should reflect the national concern for both protection and utilization of important resources.... No permit will be granted unless its issuance is found to be in the public interest."

Thus, the public interest is clearly established as a major criterion for the permit issuance decision. The Chief of Engineers' Policy on Wetlands and Corps regulations 33 CFR 320.4(b)(2) identify characteristics which make wetlands important to the public interest. Areas of Importance include wetlands and adjacent habitats which as a unit perform functions important to the public interest. Wetlands in Areas of Importance should be viewed as Wetlands of Importance per Corps regulations 33 CFR 320.4(b)(2) and 320.4(b)(4).

3. Areas of Environmental Concern are areas which are environmentally sensitive, in which any use or activity should be carefully controlled. The location of any permit activity in such areas must be carefully examined to make certain that the siting has considered the existing fragile resource. Any use or development in Areas of Environmental Concern must be subject to the following general guidelines recognized as key to the estuarine ecosystem:





FINDINGS

PLATE NO 2

LEGEND



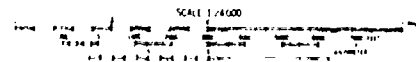
Areas of Importance



Areas of Environmental Concern



Dikes of Concern (19)



SNOHOMISH ESTUARY WETLANDS STUDY

PLATE NO 2

2

Matrix V-1
CRITERIA FOR ESTABLISHMENT OF AREAS OF IMPORTANCE
AND AREAS OF ENVIRONMENTAL CONCERN

AREAS	FUNCTIONAL CHARACTERISTICS CRITERIA												ANCILLARY CRITERIA					REMARKS	
	Biologic Functions				Ecosystem Support				Physical Protection	Storm and Floodwater Storage	Groundwater Recharge	Water Purification	Specific Local Policy	General Preservation Policy	Archaeologic and Historic	Education, Scientific, Recreation	Harvestable Resource		Visual Aesthetic
	Productivity	Vegetation	Plant and Animal Diversity	Threatened/Endangered Habitats	Hydrologic Periodicity	Location or Elevation	Areal Extent	Ecological Importance											
1. Otter Island	X	X	X			X	X	X	X	X	X	X	6,8,9	A	X			X	Nearly pristine area
2. N. Ebey Island east of I-5	X	X			X	X	X	X		X		X	6,8,9	A	X			X	Largest single wetland area in estuary
3. N. Ebey Island west of I-5	X		X		X			X					6	A		X			Unique for fresh marsh and mudflat proximity
4. Quilceda Creek	X	X	X					X				X	4,5, 8,9	A	X	X			Unique for transition zone (salt to fresh upland)
5. N. Ebey Island Reservation	X	X	X		X	X	X	X	X				6	A					
6. Smith Island	X	X	X	X	X	X	X	X	X	X			6,9	A		X			Unique for gradual transition without clear zonation
7. Highway 2	X	X	X					X				X	2,6, 8,9	A		X		X	
8. Mid-Spencer Island	X	X	X		X	X	X	X		X		X	6,8	A					
9. Maulsby Swamp	X	X										X	3	A					Strong local policy. Unique location and accessibility
10. Sunnyside Swamp		X	X					X		X		X	7,8	A				X	Minimally disturbed area in estuary
11. Jetty Island									X	X			1,3,6	A	X	X			Very strong local policy
12. Jetty Mudflats	X		X		X		X	X					1,3,6	B,F, G,P		X			
13. Ebey Island		X	X			X	X	X		X			6,8	A		X			Refuge
14. Tulalip Bay	X		X		X		X	X	X	X			8,10	B,C, F,G	X	X		X	Unique sheltered bay. Important fish hatchery.
15. Entrance Mudflats	X	X	X		X		X	X					6,8,9, G,P				X		Portion in log raft presently low productivity
16. Ebey Island, A,B,C,D		X	X					X		X			6,8	A					
17. Trailers Portion		X	X		X	X		X		X			8	A				X	
18. Fall	X	X							X	X		X		A					Planned for industry. Only known beaver habitat
19. N. Ebey Island										X				A					Partly lost in Corps' barrier dredging. Very small.
20. Maudslayi Mudflat											X		1	B,C, F,G					Presently low productivity due to log rafting
21. N. Ebey Island									X					B,C, F,G					Good maintain intertidal riparian habitat

Areas of Importance

Areas of Environmental Concern

Matrix V-1 (Continued)

KEY

- 1 Everett Comprehensive Plan
- 2 Everett Park Plan
- 3 Everett Shoreline Master Program
- 4 Marysville Comprehensive Plan
- 5 Marysville Shoreline Master Program
- 6 Port of Everett Consensus Guidelines
- 7 Snohomish County Comprehensive Plan
- 8 Snohomish County Shoreline Master Program
- 9 Snohomish River Basin Mediated Plan
- 10 Tulalip Comprehensive Plan

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- A Environmental Protection Agency (EPA)
National Marine Fisheries Service (NMFS)
Puget Sound Council of Governments (PSCOG)
Snohomish Conservation District (SCD)
State Comprehensive Outdoor Recreation and Open
Space Plan (SCORP)
Washington State Department of Ecology (DOE)
Washington State Department of Game (DOG)
Washington State Department of Natural Resources (DNR)
U.S. Fish and Wildlife Service (FWS)
and local agencies
- B Environmental Protection Agency (EPA)
Washington State Department of Ecology (DOE)
Washington State Department of Natural Resources (DNR)
- C National Marine Fisheries Service (NMFS)
U.S. Fish and Wildlife Service (FWS)
- D Snohomish Conservation District (SCD)
- F Washington State Department of Fisheries (DOF)
- G Washington State Department of Game (DOG)
- P Puget Sound Council of Governments (PSCOG)

. There must be no unnecessary alteration of drainage which would

- a. destroy vital areas;
- b. impede the natural rate or pattern of water flows within the estuarine system;
- c. reduce the natural supply of nutrients from freshwater inflows;
- d. increase the discharge of nitrogenous compounds into confined waters;
- e. increase natural turbidity and temperature;
- f. significantly change natural salinity and oxygen;
- g. increase suspended solids or toxic materials;
- h. alter or destroy shallows in inundated areas serving essential or desirable ecological functions.

Note: It is important to restate here that any permit application for any location in the study area must and will be subject to review of the extent to which such permit is in the public interest and meets all Corps criteria, including environmental criteria, for permit issuance. It should also be noted that all wetlands, whether they be in Areas of Importance or Areas of Environmental Concern or not, must and should be viewed as important. Any permit application potentially affecting any wetland in the estuary must be subjected to intensive review.

CRITERIA FOR DESIGNATION

4. Criteria for designation of Areas of Importance and Areas of Environmental Concern were developed as follows. In Corps regulations, the public interest is clearly established as a major criterion for the permit issuance decision.

5. Corps regulation 33 CFR 320-329 list factors which must be considered in defining the public interest (see also Section IV). These factors include potential impacts on important wetlands. From 33 CFR 320.4(b)(2), "Wetlands considered to perform functions important to the public interest include:

- . wetlands which serve important natural biological functions, including food chain production, general habitat, and nesting, spawning, rearing, and resting sites for aquatic or land species;
- . wetlands set aside for study of the aquatic environment or as sanctuaries or refuges;

- . wetlands contiguous to the above, the destruction or alteration of which would affect detrimentally the natural drainage characteristics, sedimentation patterns, salinity distribution, flushing characteristics, current patterns, or other environmental characteristics of the above areas;
- . wetlands which are significant in shielding other areas from wave action, erosion, or storm damage;
- . wetlands which serve as valuable storage areas for storm and flood waters;
- . wetlands which are prime natural recharge areas; and
- . wetlands which through natural water filtration processes serve to purify water."

Of the seven functions identified above, six are natural biological and/or physical functions. The seventh (study of the aquatic environment, sanctuaries, refuges) is a cultural determination, requiring the setting aside of wetlands for these purposes. In identifying wetlands which perform the biological and physical functions listed above, it is essential to consider adjacent habitats, for those habitats may have characteristics vital to the continued functioning of the wetlands. Consequently, the study team has identified areas which contain wetlands and adjacent habitats that as a unit perform functions important to the public interest.

6. In addition to the above, there are other factors which express or contribute to the public interest. In evaluating permit applications the Corps considers all applicable official state, regional, or local land use plans and/or policies as reflecting local factors of the public interest (33 CFR 320.4(j)(2)). The Corps also coordinates and consults with certain federal and state agencies (33 CFR 320.4) so that permit decisions will reflect factors of the national and statewide public interest. Federal, state, and local plans and policies thus provide additional criteria for the selection of areas important to the public interest. Such areas may be identified from specific local policies recommending particular locations to be preserved from development and from general agency policies recommending types of areas to be preserved from development. In the first case, particular areas are often defined very specifically and delineated on maps; in the second case, a general type of area such as a valuable wildlife habitat, a recreational area, or a highly biologically productive area is called out for preservation. Specific areas are then identified by first determining which areas fit the primary criterion of productivity, wildlife habitat, and so on.

7. Other expressions of the public interest may be found in cultural resources (such as archeologic or historic sites or areas used for public recreation). Areas providing economic benefits, such as harvestable resources, or aesthetically pleasing areas may also be identified as holding public interest value.

8. The criteria used in the selection of Areas of Importance/ Areas of Environmental Concern are thus based on considerations of natural biologic and physical functions, agency plans and policies, and cultural resources. These criteria are summarized below under two headings:

1) Outline of Criteria for Natural Functional Importance

- a. Natural biological functions, including productivity, vegetation density, plant and animal diversity, and threatened or endangered animal species habitats.
- b. Ecosystem support functions, including hydrologic periodicity, location or elevation, areal extent, and ecological importance.
- c. Physical protection.
- d. Storm and floodwater storage.
- e. Natural groundwater recharge.
- f. Water filtration and purification.

2) Outline of Ancillary Criteria

- a. Specific local preservation policies.
- b. General agency preservation policies.
- c. Archeologic/Historic significance.
- d. Educational, scientific, and/or recreational value.
- e. Harvestable resource value.
- f. Visual/aesthetic value.

Definitions

In applying Criteria for Natural Functional Importance, it is necessary to understand certain ecological terms and concepts. These are:

- . Ecosystem: A community of organisms, both plant and animal, and its physical environment.
- . Food web (food chain): This concept is used to describe the pathway of energy through the ecosystem, from primary producers (plants) to primary consumers (herbivores) to secondary consumers (carnivores), and ultimately to decomposers (detritivores).
- . Riparian: Adjacent to a stream or river, used to describe a habitat type.
- . Trophic: Relating to nutrition or energy conversion within an ecosystem. In a food web primary producers represent the first trophic level, primary consumers the second trophic level, and so on.
- . Detritus: Loose material which results from decomposition. In ecological systems this refers to plant and animal fragments which result from the death and decomposition of once living organisms.
- . Aquatic Interaction: The periodic or permanent movement of water through an area. Water transports detritus to aquatic lands where it can be used by detritus feeders.
- . Nutrient: Any substance which is necessary for the growth, maintenance and reproduction of an organism.
- . Productivity: The rate at which energy is stored in an organism (usually measured as the rate at which carbon is assimilated in $\text{g/m}^2/\text{yr}$). Net primary productivity is the rate at which energy is stored in plants minus that utilized for respiration. Secondary production is the energy stored by consumer organisms.

1. Criteria for Natural Functional Importance

a. Natural Biological Functions

- 1a) Primary Productivity. Wetlands which have high natural rates of net primary productivity are considered highly valuable. This net primary productivity is the basic energy source for the entire food web in the estuary. Areas with high rates of productivity can support large and diverse populations of organisms. Highly productive areas include algal beds, salt marshes, brackish/freshwater marshes and swamps. This criterion should not be used alone,

however. It is still a qualitative measure in the Snohomish estuary since no productivity measurements are available for the study area. The estimated level of aquatic interaction (see below) should be considered along with estimated net productivity. The combination of the two better describes the potential for a given area to be a source of energy for the major food webs in the estuary.

- 1b) Secondary Productivity. Aquatic lands with dense populations of benthic organisms have high secondary productivity. Benthic fauna store energy extracted from detritus, thus reintroducing it to the food chain.
- 2) Vegetation Density. Dense vegetation provides protective cover for a wide variety of animals. This is particularly important to small mammals, molting waterfowl, or other relatively defenseless animals. Dense vegetation also functions to slow water flow through the area, thus enhancing sedimentation of suspended solids and their associated nutrients and pollutants. Cattail, bulrush and mixed cattail/bulrush marshes are prime examples of dense vegetation.
- 3) Plant and Animal Diversity. The more diverse plant communities tend to support more diverse animal communities. More diverse animal communities in turn exploit the available energy resources more efficiently. Thus, in areas with more diverse animal populations, less of the energy stored as plant material is lost. In addition, diverse populations are considered to be more resistant to changes in environmental conditions. Elimination of a single species does not result in the collapse of the community. Finally, the presence of diverse populations within a single trophic level results in interspecific competition and co-evolution, thus strengthening the genetic character of the species involved (Ricklefs, 1973).
- 4) Threatened or Endangered Animal Species Habitats. Wetlands where there have been observations of a threatened or endangered or otherwise rare or unique animal species are considered important. Habitats containing locally vanishing or restricted species are also included here.

b. Ecosystem Support

This criterion refers to those areas the destruction or alteration of which would detrimentally affect natural drainage characteristics, sedimentation patterns, salinity distribution, flushing characteristics, current patterns or other environmental characteristics. For example, filling the mudflats in front of Maulsby Swamp might severely impact the flushing and hydraulic characteristics of that area.

- 1) Hydrologic Periodicity. The frequency and duration of inundation due to tides, river flow or runoff is a measure of the interaction between habitat types within an ecosystem. Subtidal algal and eelgrass habitat types exhibit continuous inundation, and therefore very high interaction with adjacent aquatic areas. Salt marshes and intertidal brackish/fresh-water marshes and swamps are usually inundated twice daily providing high aquatic interaction. Non-tidal marshes and swamps such as those behind dikes are inundated only by flooding and therefore have lower aquatic interaction with the estuarine ecosystem.
- 2) Location or Elevation. The location of a habitat is an important part of its contribution to the ecosystem. Proximity to the open water system is important when evaluating aquatic interaction. In addition, a wetland which is adjacent to other wetland areas contributes to a larger and more diverse wetland habitat. Isolated habitats, surrounded by urban or agricultural areas, may not contribute as much to the total estuarine ecosystem, although they may be productive units in themselves. Elevation of a wetland is important in evaluating the extent of the aquatic interaction between the wetland and the open water ecosystem. Hydrologic linkages deteriorate as the depth of flooding decreases.
- 3) Areal Extent. The size value of an area can be very important either by itself or in combination with contiguous related areas. A large unit provides cover and protection for wildlife. It may also provide a functionally intact system, relatively free from outside disturbances. A large unit made up of a variety of habitat types provides a diverse habitat. The shape of a habitat can also be very important in increasing the wildlife value of an area. For example, swamps and riparian habitats possess high wildlife values in different configurations. A swamp

serves identical productivity functions whether it be compact or linear. However, wildlife values to swamp species are greatly enhanced by a compact shape. The protection and security provided by the interior of a swamp are necessary for the survival of many animals which are very wary of, or cannot tolerate, human activity. In contrast, a riparian woodland has more value in a linear shape. The vegetation functions to support wildlife, provide shade for the stream or slough (maintenance of cool water temperature is important to fish habitat), provide a source of primary production to stream detritus feeders (through vegetation falling into the stream followed by decomposition), and provide habitat for insects, many of which become food for fish, or small birds. Also, dense stream or dike bank vegetation provides erosion protection.

- 4) Ecological Importance. This criterion refers to the characteristics of an area that make it valuable for resting, breeding or feeding. The characteristics required for each species are different, and include specialized nesting or spawning sites, security from predators, availability of nest sites and materials, and food sources. As knowledge of individual species requirements is refined, this criterion will become more valuable. For example, the use of the wetlands by browsing and foraging herbivores is well known. Also, the spawning and nesting of some species are known to occur in the estuary, and identification and protection of these specific habitats is important to maintain the populations.

c. Physical Protection

Wetlands included here are those that are significant in shielding other areas from wave action, erosion, or storm damage. Good examples are Jetty Island and the Tulalip spit.

d. Storm and Floodwater Storage

Wetlands are valuable if they are able to store storm or floodwaters and thereby protect upland areas from erosion and safe private property from destruction. This function is particularly critical for major floods such as occur in the Snohomish Basin every few years.

e. Natural Groundwater Recharge

Wetlands which serve as prime groundwater recharge areas are important. These areas help maintain the general groundwater table. There are no major groundwater recharge areas in the Snohomish estuary.

f. Water Filtration and Purification

Wetlands included here are those that serve to purify water through natural filtration processes. Suspended solids and associated contaminants are trapped in wetland sediments and may be released slowly through incorporation by wetland organisms. Recent studies have indicated that particular plant species and communities have the ability to concentrate or decompose contaminants, such as excess nitrogen and phosphorus compounds, heavy metals, and various hydrocarbons. For example, the cattail (Typha latifolia) has been shown to concentrate nitrogen, phosphorus and manganese by removing them from the sediment (Lee, et al, 1976). The wetland plant community thus incorporates free nutrients and releases them slowly as detritus.

2. Ancillary Criteria

a. Specific Local Preservation Policies

This criterion identifies any specific local policy statements or recommendations for preservation of the area under consideration. In the Snohomish estuary study area, particular areas recommended for preservation are identified in several documents. The Snohomish River Basin Mediated Agreement identifies preservation areas (Plate 17, Volume II). The Port of Everett's Consensus Guidelines identify areas in which the Port will not seek dredge material disposal sites (Plate 17). Three local governments have comprehensive plans, zoning, and/or shoreline master programs (SMP) which contain site-specific statements; these governments are Snohomish County, the City of Everett, and the City of Marysville. Under the SMP's for these three governments, shorelines environment designations of Conservancy, Natural, and Rural were viewed to be expressions of local desire to preserve various shorelines from urban development (Plate 16, Volume II). The Snohomish County Comprehensive Plan for the Marysville Planning Area and the Everett Community Plan each have areas specifically recommended for preservation as green belt or open space.

b. General Agency Preservation Policies

This criterion identifies any general agency preservation policies under which the area falls. For example, the U.S. Fish and Wildlife Service (FWS) discourages encroachment into biologically productive wetlands. It should be noted that FWS has a broader definition of wetlands than that stated in 33 CFR 323.4 (see Section II). Similarly, the State Comprehensive Outdoor Recreation and Open Space Plan (SCORP) recommends for preservation in the natural state those swamp, marsh, or bog sites with natural qualities and unique value for wildlife conservation, scientific, educational, or recreational purposes. Agencies with such general preservation policies include federal (FWS, NMFS, EPA), state (DOE, Game, Fisheries, SCORP, DNR), regional (PSCOG) and various local governments and agencies. These agencies and their policies are discussed in detail in Section VII, Volume II.

c. Archeologic/Historic Significance

The criterion identifies whether the area under consideration has archeologic or historic significance. Known archeologic areas and historic sites in the Snohomish estuary study area are shown in Plate 19 (Volume II). The existence of an archeologic or historic site in a given area adds to the area's public interest value. The State Office of Archeology and Historic Preservation is responsible for the promotion and enhancement of preservation efforts and public interest in such sites.

d. Educational, Scientific, and/or Recreational Value

The criterion identifies whether an area is known to be used for recreation or for educational or scientific study. In the Snohomish estuary certain groups were identified as users of particular wetland areas for educational or research purposes. These groups include local school districts and interest groups such as the Audubon Society. These are discussed in Section VII. No formal sanctuaries or refuges exist in the Snohomish estuary study area, although the large parcel of land on Ebey Island owned by the State Department of Game is managed as a refuge. Areas used for recreation are shown on Plate 19 and discussed in Section VII, Volume II; they include parks, marinas, and public access boat launch and fishing areas.

e. Harvestable Resource Value

The criterion identifies whether an area is used for commercial or sport hunting or fishing or whether it is essential as habitat for species of commercial or recreational importance. Such harvestable resources generate direct economic benefits and preservation of areas important for maintenance of these resources is in the public interest.

f. Visual/Aesthetic Value

This criterion identifies whether an area is considered to provide a visually or aesthetically pleasant experience to most observers. In the Snohomish estuary views from roads and buildings were subjectively rated as good, average, or poor. Areas considered to provide a good view are held to be areas of public interest.

9. The above criteria are not all equal in importance. Those criteria derived from the factors listed in 33 CFR 320.4(b)(2) were considered more important than the others and were given greater weight in the process of areas designation. All criteria under Natural Functional Importance and the Ancillary Criterion of Educational or Scientific Value are considered very significant, and areas which meet many or all of these criteria were generally designated Areas of Importance. Areas which meet fewer of these criteria were designated Areas of Environmental Concern. All criteria involving local, state or federal policy, other than 33 CFR 320.4(b)(2) were given lesser weight than the physical and biological criteria. The process of criteria weighting and application was performed subjectively by the study team.

DESIGNATED AREAS

10. In the Snohomish estuary study area, 14 areas are identified as Areas of Importance (Plate 2). These are as follows:

1. Otter Island
2. North Ebey Island, east of I-5
3. North Ebey Island, west of I-5, east of Tulalip
Reservation
4. Quilceda Creek
5. North Ebey Island, on Tulalip Reservation, including
Quilceda Island
6. Smith Island
7. Highway 2
8. Mid-Spencer Island

9. Maulsby Swamp
10. Sunnyside Swamp
11. Jetty Island
12. Jetty Island Mudflats
13. Ebey Island Washington Department of Game Land
14. Tulalip Bay

Another seven areas are identified as Areas of Environmental Concern; these are:

15. Entrance Mudflats
16. Ebey Island, A, B, C
17. Cavalero Corner
18. Lowell
19. Weyco Islands
20. Maulsby Mudflats
21. Dikes of Concern

The areas are not listed here in order of importance. Both the Areas of Importance and the Areas of Environmental Concern are shown on Plate 2; the number of each area is listed on the Plate for easy identification. The boundaries of each area are defined by physical and biological criteria; each area represents wetlands and adjacent habitat identified as a functioning unit.

11. Matrix V-1 shows which criteria are met by each Area of Importance (AOI) and Area of Environmental Concern (AEC). The matrix does not indicate the relative importance of the criteria but merely shows whether they are met or not. It can be seen from the matrix that some of the AOI do not meet many of the criteria. However, the significance lies in which criteria are met. As stated above, the AOI generally meet most of the criteria for Natural Functional Importance and Ancillary Criterion for Educational or Scientific Value. In the case of an area such as (3) North Ebey Island, west of I-5, which meets only a few of the criteria, the Remarks column of the matrix indicates additional factors which contributed to the designation of the area as an AOI.

12. Each Area of Importance or Area of Environmental Concern is described in detail in the format shown on Template 2 (page). The title of Template 2 is either Area of Importance or Area of Environmental Concern, depending on area presented. Shown in Template 2, the location and total acreage of the area is shown, the habitat types (Burrell, 1978; see description in Section V.A) that constitute each area are given with their acreage in the area, and percentage acreage in the estuary. The history of each area, in terms of diking, logging, and other activities is presented. The natural functional importance of the area is discussed; the questions on Template 2 reflect the criteria for judging natural functional im-

portance; that is, the physical and biological importance of the area. The ancillary importance of the area, that is its importance in terms of public policy and cultural resources, is also described. Last, as shown on Template 2, the pressure for development of the area is described. The purpose of a format such as Template 2 is to provide for the reader a complete description of the important characteristics of each area in a brief and easily readable manner. Such a format also allows a ready comparison between areas.

Template 2 (Sample format)

AREA OF IMPORTANCE/AREA OF ENVIRONMENTAL CONCERN

LOCATION: Name and identification number as indicated on Plate 2 Total Acreage: As calculated by Burrell, 1978

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. Classification	Acreage	% of total	Points of interest concerning each habitat type. For example, largest single parcel within estuary; brackish swamp behind saline marsh; exhibiting successional change to swamp.
2. name and number	of each	area of each	
3. of each habitat	habitat	type within	
4. within area as	type at	the estuary	
defined by	location		
Burrell, 1978			

History of Area:

Has the area been diked? When? Were the dikes breached? When?
Has the area been logged? When? Have adjacent activities affected the area? How? When?

Natural Functional Importance:

What important natural biological functions does this area perform? Is it highly productive, providing an important input to the food web of the estuary? Is it an important nesting, resting, breeding or feeding site for wildlife in the estuary? Does this area provide important ecosystem support for another important wetland area? (This support might include aids to drainage, control of sedimentation patterns, salinity, flushing characteristics or current patterns). Does this area serve to protect other areas from storm or wave induced erosion? Does the area provide storage for floodwater? Does the area function to recharge local groundwater? Does the area act as a water filtration site, aiding in water quality maintenance?

Ancillary Importance:

Are there specific local policies for preservation of this area? Have local jurisdictions identified this area for particular purposes, and if so, what? How does the area relate to general federal, state, regional, or local preservation policies? Is there an archeologic or historic site in the area? Is the area used for edu-

cational, scientific, or recreational purposes? Does it have a high aesthetic value? Is it valuable for commercial or sports fishing or hunting?

Development Pressure:

What is the present land use and recent permit history in the area? What is the use of surrounding lands and water? What is the Accessibility and availability of urban services? What are the specific local policies permitting development? Ownership of the area and adjacent lands and tidelands? What is the current zoning? Summary statement of development pressure.

Note: A star (*) under Habitat Type means this type of habitat is generally under Corps jurisdiction.

The symbol (W) means the habitat type is a Wetland under Corps definition 33 CFR 323.2(c).

AREA OF IMPORTANCE

LOCATION: (1) Otter Island

Total Acreage: 147

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *6111 Spruce Swamp(W)	82	28	Largest parcel of habitat within estuary
2. *6252 Cattail/Bulrush Marsh (W)	65	10	Numerous shrubs within habitat indicate successional transformation toward swamp

History of Area

Approximately 4 acres along west shore was diked around 1900, probably for agricultural use. The dike was breached by 1947. There is no other evidence of disturbance in the area.

Natural Functional Importance

This marsh is a highly productive plant community. The marsh also provides feeding and nesting habitat for red-wing blackbirds, bitterns, rails and other marsh birds. The cattails and bulrushes are food sources for muskrats. The spruce swamp provides browse forage for deer, muskrat and other herbivores. The numerous associated rodents provide food for carnivores, especially hawks, owls, and minks. The spruce swamp provides nesting/breeding habitat for raptors, wood duck, muskrat, and mink. The large compact, isolated unit provides security for wildlife. The island provides some floodwater storage area. Since regrowth is slow, the mature spruce swamp is sensitive to any activity which would kill the trees.

Ancillary Importance

The entire island has been designated for preservation under the Snohomish River Basin Mediated Plan. It is designated Conservancy in the Shohomish County Shoreline Master Program. It is within the non disposal area under the Port of Everett's Consensus Guidelines. As a highly productive swamp/marsh wildlife habitat, it is under general preservation policies of FWS, NMFS, EPA, Game, DOE, DNR, SCORP, PSCOG, and SCD. There is an archeologic site on the island. The island is in the viewshed of residences to the east.

(Continued)

LOCATION: (1) Otter Island

Development Pressure

Otter Island has never been used extensively and is presently in open space. It has not been the location of any permit requests in recent years. The lands around it are either in agriculture or open space, except for the Lake Stevens sewage treatment plant which is just upstream. The island is only accessible by boat and has no urban services available. Otter Island is almost entirely under one owner, who also owns large and more accessible portions of Smith Island and Spencer Island. The state owns a tiny parcel of the east side of the island and also owns the surrounding tidelands and bedlands. The island is zoned Rural Use (RU), as is most of the area around it. Because of its past history, its inaccessibility, and the many policy indicators for preservation, development pressure is viewed to be negligible.

AREA OF IMPORTANCE

LOCATION: (2) North Ebey Island
East of I-5

Total Acreage: 322

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *6111 Spruce Swamp(W)	35	12	
2. *6112 Shrub Swamp(W)	6	3	
3. *6252 Cattail/Bul- rush Marsh(W)	267	42	Largest single parcel in estuary
4. *6254 Sedge Marsh(W)	9	35	Largest single parcel in estuary
5. 155 Dike	5	4	Dike; mixed blackberry and riparian

History of Area

The westernmost portion of the area was diked prior to 1911, the remainder sometime later, probably for agricultural use. The dikes of the southern section were breached between 1941 and 1947, and those of the western and central sections between 1950 and 1963. Because the dikes were not repaired, all areas have reverted to wetland habitats. About 9 acres next to I-5 in the northwest portion have been filled; the area shown as Wetland Area of Importance does not include this fill.

Natural Functional Importance

Cattail and bulrush are both highly productive species. They also provide shelter and nesting for a variety of birds and small mammals. Cattail, bulrush and sedge are all valuable food for numerous waterfowl and small mammals. The spruce swamp offers nesting and feeding habitat for wood duck, raptors, songbirds, and furbearers. The swamp may also provide shelter and forage for deer, muskrat and other herbivores. The elongate shape, high shoreline-to-area ratio and numerous tidal creeks create significant aquatic interaction resulting in both detritus export and nutrient regulation through sedimentation of suspended solids. Thus the area is important in maintenance of natural water quality of the estuary.

Ancillary Importance

The Snohomish River Basin Mediated Plan recommends preservation of

(Continued)

LOCATION: (2) North Ebey Island
East of I-5

this entire parcel except for the existing fill. That portion located within Snohomish County (the middle and southeast portions) is designated Conservancy under the Shoreline Master Program. It is within the non-disposal area under the Port of Everett's Consensus Guidelines. As a highly productive, diverse, wetland wildlife habitat, this area is under general preservation policies of FWS, NMFS, EPA, DOE, Game, DNR, SCORP, PSCOG, and SCD. The area has several identified archeologic sites. It is in the viewshed of residences and roads to the east.

Development Pressure

The area is best discussed as separate parcels. The northwest parcel, from the existing fill to the narrow neck of land opposite the Marysville sewer lagoon, is under much more immediate development pressure than the middle and southeastern parcel. There is a permit application for dredging, filling, and construction on 45 acres of this parcel. The northwest parcel is easily accessible by road. It is in the city of Marysville and is mostly Urban under Marysville's SMP. The State DOE shows it as mostly Conservancy. The northwest parcel is under one owner, who also owns the southeastern part. The middle portion is under another single ownership. The middle and southeastern parts are not easily accessible. Tidelands along the middle and southeastern portions are state-owned but leased out. The Snohomish County rural (RU) zone covers all of the middle and southeast portions. Because of its proximity to the existing fill, its accessibility, and the pressure from Marysville to dedicate it to urban uses, the northwest parcel is under immediate pressure to develop. Because of the various preservation policies on the middle and southeastern parcels, development pressure on this area is less.

AREA OF IMPORTANCE

LOCATION. (3) North Ebey Island, west of
I-5, east of Tulalip Reservation

Total Acreage: 53

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *571 Slough	8	17	
2. *624 Salt Marsh(W)	1	8	
3. *6252 Cattail/Bul- rush Marsh(W)	42	7	
4. *6262 Cattail Marsh(W)	2	8	

History of Area

This area was diked before 1911 and by 1963 the dikes had been breached, allowing the area to revert to wetland. Construction of the railroad (1895) and Highway 99 (1926) sectioned the area. Construction of I-5 (1968) provided the eastern boundary to the unit.

Natural Functional Importance

The cattail and bulrush marshes in this area are highly productive and probably export considerable detritus to nearby mudflat and slough habitats for consumption by benthic invertebrates. The abundant populations of benthic invertebrates are a food source for numerous shorebirds such as sanderlings, dunlins and sandpipers, and waterfowl such as mallards, shovelers and pintails. The juxtaposition of marsh and mudflat provides important interaction; waterfowl nest in the marsh, feed in the mudflats and slough, on benthic organisms which feed on marsh detritus. This is the only example of fresh marsh and mudflats in close proximity in the entire study area.

Ancillary Importance

Because of the unique nature of this area in the estuary and its value as waterfowl habitat, it falls under preservation policies of FWS, NMFS, EPA, DOE, Game, DNR, SCORP, PSCOG, and SCD. It is readily accessible for educational and scientific study. The area is within the non-disposal area under the Port of Everett's Consensus Guidelines.

(Continued)

LOCATION: (3) North Ebey Island, west of I-5,
east of Tulalip Reservation

Development Pressure

This area is under very heavy development pressure. For example, a permit application for dredge, fill, and other activities is presently undergoing Corps and agency review; it is highly controversial. An extensive fill is located just west of the area and another fill is located directly east. The area is sectioned by several transportation corridors. The area is in the city of Marysville, and Marysville's Shoreline Master Program shows it as Urban. DOE shows it as Conservancy. Most of this area is under the same ownership as the land east of I-5. The Snohomish River Basin Mediated Agreement recommends an economic development plan for "the area west of I-5", and there appears to be a general feeling that industrial development will occur mostly west of I-5. Such feelings may contribute to continued pressure to develop this area, as may the proximity of this area to existing fills.

AREA OF IMPORTANCE

LOCATION: (4) Quilceda Creek

Total Acreage: 302

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *572 Marine Slough	3	21	
2. *6111 Spruce Swamp(W)	47	16	
3. *6241 Sedge Marsh(W)	33	29	
4. *6242 Mixed Marsh(W)	25	40	
5. *6243 Mixed Marsh(W)	3	27	33% of salt marsh in estuary
6. *6244 Mixed Marsh(W)	44	33	
7. *6245 Sedge Marsh(W)	6	23	
8. *6246 Bulrush Marsh(W)	19	31	
9. *6250 Brackish Marsh(W)	22	84	
10. *6252 Bulrush/Cattail Marsh(W)	83	13	
11. *638 Mud Flat	17	47	

History of Area

There has been very little activity in this area. A railroad spur once extended along the south shore. A portion of the south shore was bulkheaded and filled for log storage (tidal connection for remaining marsh was maintained). The area is within the Tulalip Reservation boundaries.

Natural Functional Importance

The marsh communities are all highly productive. These diverse communities provide food, shelter and nesting area for a variety of wildlife. The proximity to a large wooded area provides feeding area for upland species. The dense vegetation provides security and protection for various wildlife. Juvenile salmon migrating down the creek begin schooling in the vicinity of Ebey Slough; these salmon feed on the benthic invertebrates found on the mudflats and along slough bottoms. The numerous drainage channels provide important aquatic interaction for trapping suspended solids and exporting detritus, thus aiding water quality and estuarine productivity. This is the only example of salt marsh-brackish swamp-fresh marsh-upland zonation in the study area.

Ancillary Importance

The Snohomish River Basin Mediated Agreement shows this area for

(Continued)

LOCATION: (4) Quilceda Creek

preservation. The Snohomish County Marysville Area Comprehensive Plan shows this area as greenbelt. The Snohomish County SMP designates it as Conservancy, and this has generally been accepted by the Tulalip Tribes. The City of Marysville SMP shows Conservancy on Quilceda Creek upstream of this area. Because of the unique nature of this area in the estuary and its value as wildlife and fish habitat, it falls under preservation policies of FWS, NMFS, EPA, DOE, Game, DNR, SCORP, PSCOG, and SCD. There are archeologic sites in this area. It is used by several school districts for field trips as a biological study area. Access and unique zonation make this an excellent research and education site.

Development Pressure

The area is wetland/open space. No permit applications have been filed in the area except along the south shore. The surrounding area is wetland/open space. The area is easily accessible. There are no policies encouraging development here. The land is on the Tulalip Reservation. Development pressure on this area is negligible.

AREA OF IMPORTANCE

LOCATION: (5) North Ebey Island, on Tulalip Reservation, including Quilceda Island

Total Acreage: 207

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *572 Marine Slough	11	79	
2. *6111 Spruce Swamp(W)	11	4	
3. *6241 Sedge Marsh(W)	21	18	
4. *6242 Mixes Salt Marsh(W)	21	42	
5. *6243 Mixed Salt Marsh(W)	8	73	
6. *6244 Mixed Salt Marsh(W)	81	60	
7. *6245 Sedge Marsh(W)	13	50	
8. *6246 Bulrush Marsh(W)	21	34	
9. *6252 Cattail/Bulrush Marsh(W)	19	3	
5253 Cattail Marsh(W)	1	3	

50% of salt marsh in the estuary.

History of Area

Western portion of North Ebey Island was included as part of Tulalip Reservation in Treaty of 1855. No diking or logging has occurred on the island. The 160 acre sanitary landfill on the island was begun in approximately 1966. The landfill site is filled almost to capacity at present.

Natural Functional Importance

Most salt marsh species are highly productive. The marshes and swamps provide nesting and breeding for a variety of waterfowl and other birds. Cattail and bulrush provide food for both waterfowl and small mammals. Spruce provides nesting for raptors and songbirds. The inaccessibility of the area provides security for wildlife. Diverse habitats provide a variety of plant species for food and shelter. Aquatic interaction aids detritus export and suspended sediment trapping. The area acts as a buffer, slowing discharge of landfill leachates into the aquatic system. The area has good examples of habitat zonation and successional sequence in marine and brackish wetlands. It protects the landfill from erosive wave action.

Ancillary Importance

The area is within the non-disposal area under the Port of Everett's

(Continued)

LOCATION: (5) North Ebey Island, on
Tulalip Reservation, including Quilceda Island

Consensus Guidelines. Because of its productivity and value as wildlife habitat, it falls under preservation policies of FWS, NMFS, EPA, DOE, Game, DNR, SCORP, PSCOG, and SCD.

Development Pressure

The area is wetland open space with no permit history. The mudflats to the west are used for log storage; the landfill to the east has not yet been developed. The area is not readily accessible by road. No shoreline designations are shown for this area because of disagreement between the Tulalip Tribes and Snohomish County. The area is on the Tulalip Reservation. Its location west of I-5 and its proximity to existing fill may contribute to pressure to develop this area (see also Area 3, North Ebey Island).

AREA OF IMPORTANCE

LOCATION: (6) Smith Island

Total Acreage: 93

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. 4221 Immature Broad- leaf	12	6	
2. *522 Inland Pond	1	6	
3. *6112 Swamp(W)	3	1	
4. *6242 Sedge Marsh(W)	45	39	
5. *6242 Mixed Salt Marsh(W)	5	10	
6. *6246 Bulrush Marsh(W)	21	34	
7. *6252 Cattail/Bulrush Marsh(W)	6	1	

History of Area

Construction of wood product waste treatment ponds between 1947 and 1955 increased sediment deposition on the eastern edge of this area. Some deposition may have resulted from construction of the dike around the ponds, the remainder from hydraulic changes in the vicinity.

Natural Functional Importance

The diverse marsh species, especially sedge, cattail and bulrush are highly productive. Bulrush and cattail provide feeding and nesting area for songbirds, shorebirds and small mammals. The swamp and broad-leaf forest provide feeding and nesting area for numerous songbirds and mammals. Deer rest in the upper edges of the marsh and graze along the edge of the nearby woodland. There are unpublished reports of bald eagles resting in the spruce. The small pond is a feeding and resting area for waterfowl, which will also feed and nest in adjacent marsh areas. The isolation of this area offers security for the wildlife which use it. The marsh and swamp habitats provide some protection to the treatment ponds from wave attack. The gradual transition from marsh to upland without clear zonation is the only example in the estuary.

Ancillary Importance

The Snohomish River Basin Mediated Agreement recommends this area for preservation. It is within the non-disposal area under the Port of Everett's Consensus Guidelines. Because of the unique nature of this area in the estuary, its productivity, and its value as wildlife habi-

(Continued)

LOCATION: (6) Smith Island

tat, it falls under general preservation policies of FWS, NMFS, EPA, DOE, Game, DNR, SCORP, PSCOG, and SCD. It is used by the Everett School District as a wetland study area. Because it is a gradual transition zone, it is valuable for research.

Development Pressure

The area is partly wetland and partly in industrial (forest products) use. Surrounding areas are used for log storage, wood waste treatment ponds; there is some remaining open space just east of the area. The area is accessible by road. It is in Snohomish County and is shown as Urban in Snohomish County's Shoreline Master Program. It is under several small ownerships. The surrounding tidelands are all under private ownership. Zoning in the area is a mixture of rural (RU) and light industry (LI). Because of its proximity to and accessibility from existing industrial uses and its location west of I-5, there will be pressure to develop this area.

AREA OF IMPORTANCE

LOCATION: (7) Highway 2

Total Acreage: 68

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *6112 Shrub Swamp(W)	42	19	Largest single parcel in estuary
2. *6252 Bulrush/Cattail marsh(W)	11	2	
3. *6253 Cattail Marsh(W)	15	42	Largest single parcel in estuary

History of Area

There is no indication of either diking or logging in this area. Highway 2 was originally constructed before 1895. The bridge was located about 0.5 miles downstream of its present location, with the Ebey Island approach bisecting the area. The bridge was moved to its present location before 1910. The 1884 map identifies this location as wetland, the 1895 does not. The 1942 USGS quadrangle identifies the area as wetland. The Everett water pipelines were installed before 1947.

Natural Functional Importance

The bulrushes and cattails are both highly productive species. The numerous channels provide aquatic interaction to export this productivity. The diverse vegetation of the marsh and swamp provide feeding, nesting and breeding habitat for numerous songbirds and small mammals. This area exhibits a prime example of the cattail marsh to shrub swamp transition zone. The area also provides floodwater storage.

Ancillary Importance

The Snohomish River Basin Mediated Agreement recommends this area for preservation. It is within the non-disposal area for the Port of Everett's Consensus Guidelines. It is designated Conservancy in Snohomish County's SMP. As a highly productive natural area and a valuable wildlife habitat, it falls under preservation policies of FWS, NMFS, EPA, DOE, Game, DNR, SCORP, PSCOG, and SCD. It is easily accessible for educational or research field trips (although it has not been mentioned by any group as presently in this type of use).

(Continued)

LOCATION: (7) Highway 2

The City of Everett shows this area as a possible future park. It contributes to a good view from Highway 2.

Development Pressure

This area is wetlands traversed by a highway and a water pipeline, both supported on piles instead of on fill. Neither structure has seriously affected water circulation in the wetland. Surrounding land is in agricultural use; the river is used for log rafts. The area is readily accessible along the dike road and from Highway 2. There are no local policies encouraging development of this area. The area is under various small ownerships. It is under Snohomish County rural (RU) zoning. The surrounding tidelands are state-owned but leased out. Development pressure on this area is viewed to be slight.

AREA OF IMPORTANCE

LOCATION: (8) Mid-Spencer Island

Total Acreage: 88

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *571 Freshwater Channel	13	27	
2. *6111 Spruce Swamp(W)	2	<1	
3. *6112 Shrub Swamp(W)	17	8	
4. *6252 Bulrush/Cattail Marsh(W)	56	9	

History of Area

Approximately 70 acres in the northern portion of this site were diked prior to 1884, probably for agriculture. By 1969 the dikes had been breached and the area was reverting to wetland. Between 1955 and 1963 a channel was dredged from Steamboat Slough to Union Slough through the narrowest portion of this site. A wood waste fill has been extended along the southwestern portion of this location since 1974.

Natural Functional Importance

The cattail/bulrush marsh is highly productive. There are numerous channels connecting the area to both Union and Steamboat Sloughs, thus providing extensive aquatic interaction for export of detritus. The proximity to large open water bodies makes the area an important feeding, resting, and nesting habitat for waterfowl. Herons and other shorebirds feed along much of the breached dike shoreline of this area. The swamp is available nesting and feeding habitat for songbirds and mammals. Raptors use the spruce for nesting and resting. The proximity of the area to Otter Island and the south end of North Ebey Island creates an important system of interacting water and aquatic lands habitat types. The extensive network of tidal channels allows the area to filter large amounts of estuarine water, removing suspended solids.

Ancillary Importance

This area is within the non-disposal area for Port of Everett's Consensus Guidelines. It is designated Rural in Snohomish County's SMP. As a highly productive area and a valuable wildlife habitat,

(Continued)

LOCATION: (8) Mid-Spencer Island

it falls under preservation policies of FWS, NMFS, EPA, DOE, Game, DNR, SCORP, PSCOG, and SCD.

Development Pressure

The area is presently wetland open space, but has been diked in the past. The surrounding land is in agricultural use or is wetland/open space. The area is quite inaccessible, with no public roads. The area is under one owner, who owns about 1,000 acres in the estuary. It is zoned rural (RU) by Snohomish County. The surrounding tidelands are state-owned. Because of its inaccessibility, development pressure is generally low, although there may be some pressure to extend the woodwaste fill areas to the southwest.

AREA OF IMPORTANCE

LOCATION: (9) Maulsby Swamp

Total Acreage: 16

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *6251 Bulrush Marsh(W)	16		

History of Area

The swamp was originally a small pocket beach located in the indentation in the bluff. Construction of the railroad in about 1890 isolated the area and provided a culvert for drainage. The protection and ponding created by the railroad allowed the area to transform into the marsh that is present today.

Natural Functional Importance

This brackish marsh is highly productive and probably exports much of this productivity to detritivores of the adjacent mudflats. Red-wing blackbirds nest in the area. Herons, mallards, sandpipers, swallows and sparrows have all been observed feeding in the area. A variety of birds, especially insectivorous songbirds, probably nest in the shrub swamp and uplands adjacent to the area. The area probably acts as a filter for runoff coming down the bluffs, removing some suspended solids prior to its discharge across the mudflats.

Ancillary Importance

This area is in the city of Everett and has been given a special environmental designation under Everett's SMP. It is designated Conservancy-Resource Protection because of its biological and ecological qualities; activities allowed there include educational and scientific investigation and public enjoyment of a natural area. Because of its unique nature in the estuary and its productivity, it falls under general preservation policies of FWS, NMFS, EPA, DOE, Game, DNR, SCORP, PSCOG, Everett, and SCD. Although not mentioned as in educational use at present, it is easily accessible for research field trips.

Development Pressure

Maulsby Swamp is isolated from residential development to the east, north, and south by topography (it is at the foot of a high bluff)

(Continued)

LOCATION: (9) Maulsby Swamp

and from industrial development to the west by a highway. It has only one point of interaction with tidal waters; this is a culvert under the road at the south end of the swamp. Maintenance of water flow through this culvert is essential to the biologic functioning of Maulsby Swamp. The swamp is accessible on foot from the road. Development pressure on this area is viewed to be negligible because of the preservation policies of Everett. However, the swamp could be hurt by development around it. Uncontrolled urban runoff from increased residential development on the bluff could degrade water quality in the swamp; however, the bluff appears to be already in stable development. More importantly, uncontrolled or improper development or filling of the mudflats around the culvert could change the hydrology of the area and the nature of tidal interaction with the swamp. There is presently some pressure to develop the mudflats west of the swamp.

AREA OF IMPORTANCE

LOCATION: (10) Sunnyside Swamp

Total Acreage: 31

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *6111 Spruce Swamp(W)	30	10	
2. *6254 Sedge Marsh(W)	1	4	

History of Area

This area appears to have been diked, however, the date of diking has not been determined. The land was not cleared and the dikes were breached prior to 1947. Since then it has remained altered.

Natural Functional Importance

The sedge marsh is highly productive. Sedge is an important food source for waterfowl. The narrow slough-side marsh readily exports its primary productivity to the aquatic ecosystem. The adjacent swamp provides nesting and feeding habitat for songbirds and small mammals. The swamp, located next to an upland woods and shrub thicket offers a diversity of habitat to deer, mink, and other mammals which use both habitat types. The spruce offer valuable nesting and resting habitat to raptors. This is a minimally disturbed natural area within the estuary.

Ancillary Importance

This area is designated Rural in Snohomish County's SMP. The Snohomish County Marysville Area Comprehensive Plan shows it as greenbelt. Because of its value as wildlife habitat, this area falls under preservation policies of FWS, NMFS, EPA, DOE, Game, DNR, SCORP, PSCOG, Marysville, and SCD. It is readily accessible to Sunnyside School, making it potentially useful for educational field trips. It contributes to a good view from roads and residences to the east.

Development Pressure

The area is presently wetland open space, with surrounding lands to the west, north, and south in wetland or agriculture and residential development and a school to the east. It is not accessible by road, but is easily reached on foot from the school. The area is in vari-

(Continued)

LOCATION: (10) Sunnyside Swamp

ous small ownerships. It is zoned for rural residential uses (low to medium density). Although development pressure on this area is negligible at present, its relative accessibility and its zoning increase pressure to develop in the future.

AREA OF IMPORTANCE

LOCATION: (11) Jetty Island

Total Acreage: 159

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. 182 Dredge Fill	34	--	
2. 312 Beach Grassland	49	--	
3. 321 Successional Shrubl8		--	
4. *622 Algal Assoc.(W)	11	--	
5. *6241 Sedge Marsh(W)	0.5	--	
6. *6247 <u>Salicornia</u> Marsh(W)	3	--	40% of <u>Salicornia</u> in estuary
7. *636 Sand Flat	11	--	
8. *638 Mud Flat	32	--	

History of Area

Jetty Island is formed from natural deposition and dredge material disposal around the jetty, built in 1895.

Natural Functional Importance

The mud and sand flats support large populations of sediment dwellers. These in turn are a food source for shorebirds, some waterfowl and numerous small fish including juvenile salmon, trout and flat fish. These fish are a major food source for the great blue herons which feed here extensively. Some small mammals occupy the island, providing food for raptors. The island provides a security buffer from industrial area for waterfowl. Island and associated flats protect Port of Everett from storm induced waves and erosion.

Ancillary Importance

Jetty Island is in the city of Everett and the Port of Everett. The City of Everett's Community Plan specifically recommends preservation of either the entire island or all but the southernmost portion of the island for open space, educational use, and public recreation. The plan further declares that no industrial use should be developed on the island unless there is demonstrable need and all other alternatives have been exhausted. Everett's SMP shows a special environment designation for Jetty Island; it is a Diverse Resource Management Area, and specific management policies, including the development of a comprehensive plan for the island, must be implemented before any devel-

(Continued)

LOCATION: (11) Jetty Island

opment is allowed there. All these policies point toward preservation of Jetty Island. The Port of Everett's Consensus Guidelines contain seven policies specifically relating to Jetty Island (in these Guidelines, Jetty Island includes upland, wetland, and tide-flats); several of these refer to the Jetty Island comprehensive plan to be developed. Three of these policies make specific reference to preservation and non-development of Jetty Island. Because of the uniqueness of the Jetty and its value as waterfowl habitat, it falls under general preservation policies of FWS, NMFS, EPA, DOE, Game, DNR, SCORP, PSCOG, Everett, and SCD. Jetty Island has been recommended as an historic site, but formal applications have not been made. There is a recreational boat landing on the island (leased by State Parks from the Port). The Everett School District uses Jetty Island for study of aquatic biology.

Development Pressure

Jetty Island is not presently used by industry; however, the waters and lands to its east are used for log rafting and intensive Port activities. The island is used for recreation and education. It is only accessible by boat. About 25 acres at the southernmost end are proposed for dredge material disposal by the Port; however, the Port's Consensus Guidelines contain a policy to mitigate the impacts of filling tidelands by designating on Jetty Island at the time of each filling an equal area of wetlands, tidelands, and/or uplands for marine, park use. The Port of Everett claims ownership of Jetty Island, but this is disputed by DNR. The comprehensive plan for the island will have to be developed by local agencies and the public, according to Port Guidelines. Everett's SMP designates disposal on Jetty Island as a conditional use, to be allowed only if all other sites in the disposal plan are not available. Development pressure on the island is low, since local agency policies generally tend to emphasize preservation.

AREA OF IMPORTANCE

LOCATION: (12) Jetty Island Mudflats

Total Acreage: 3,632

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *54 Bays	607	--	
2. *622 Algal Assoc.(W)	183	--	
3. *623 Eelgrass(W)	1,332	--	
4. *637 Sand/Silt Flats	1,510	--	

History of Area

The extent of the mudflats prior to construction of Jetty Island and the dikes is not known. The flats have probably been extending westward throughout recent geologic time. Timber harvest and dike construction have probably increased the amount of sediment brought to the river mouth. Diversion of the main channel probably increased deposition south of Jetty Island. Subsequent dredge material disposal west of the jetty has added to the area of the flats. Neither the present rate, nor the change in rate of the growth of the flats due to all the activities is known.

Natural Functional Importance

Eelgrass and algae are both highly productive species which contribute extensive detritus to the aquatic ecosystem. This detritus is the primary food source for the dense populations of detritivores inhabiting mud and sand flats. These detritivores in turn are the primary food source for herring, smelt, juvenile salmon and other small fish, and also a wide variety of shorebirds and waterfowl. Eelgrass is a major spawning substrate for herring. Eelgrass also acts as a nursery habitat for salmon, smelt, herring, shad, sole and flounder. Crabs commonly feed in the eelgrass beds. The shallow flats are a critical schooling area for salmon and searun trout. The nearshore area from Priest Point to Tulalip Bay is an important shellfish area with populations of clams and cockles. The abundant and diverse populations of fish make the area important for both sport and commercial harvest.

Ancillary Importance

Everett's Community Plan specifically states that industrial develop-

(Continued)

LOCATION: (12) Jetty Island Mudflats

ment on or by extension of Jetty Island to the west by filling in Port Gardner Bay is unacceptable. This plan also has a specific policy prohibiting filling of tidal flats. About 1,650 acres of the Jetty Island Mudflats area is included as part of Jetty Island in the Port's Consensus Guidelines. Important Port policies relating to preservation of the mudflats in particular are those on the acre-for-acre designation of areas for preservation at the time tideland fills are made (see Area 11, Jetty Island) and on the development of a comprehensive plan. As a highly productive fish habitat and migration route, this area falls under preservation policies of EPA, DOE, DNR, Fisheries, and Game. PSCOG has a specific policy that publicly owned tidelands should remain in public use. About 200 acres of Jetty Island, including tideflats, are leased to DNR as a marine park. The Jetty Island Mudflats are used as an aquatic biology study area by the Everett School District. These mudflats provide a schooling area for anadromous fish (salmon), a commercial resource.

Development Pressure

The Jetty Island Mudflats are presently open area, not used for commercial fishing because of shallow water. Sport boating takes place in the area. They are only accessible by boat or on foot from Jetty Island. The Port of Everett claims ownership of part of the mudflats but this is disputed by DNR. There is a specific Port policy on the placement of dredge materials on these mudflats at the southern end of Jetty Island. Except for this area, development pressure is low, since local agency policies tend to emphasize preservation and non-development.

AREA OF IMPORTANCE

LOCATION: (13) Ebey Island, Washington
State Department of Game

Total Acreage: 518

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. 155 Dike	4	3	
2. 321 Shrub	6	--	
3. 42 Broadleaf Forest	89	12	
4. 43 Mixed Forest	1	1	
5. *611 Intertidal Swamp (W)	27	5	
6. *612 Fresh Swamp (W)	388	65	60% of fresh swamp in the estuary
7. *626 Fresh Marsh (W)	3	3	

History of Area

Ebey Island was diked early in this century, but this parcel has never been logged or used for other purposes.

Natural Functional Importance

This area provides habitat for large populations of wildlife. The diverse wooded area provides feeding, breeding and resting habitat for raptors, songbirds, deer, mink, raccoon and numerous mammals. Many species may use both the swamp and the adjacent estuarine areas. Others may rest and breed here and feed on rodents in neighboring agricultural areas.

Ancillary Importance

The shoreline of this area is designated Rural under Snohomish County's SMP. The area is within the non-disposal area under the Port of Everett's Consensus Guidelines. As valuable wildlife habitat, this parcel falls under general preservation policies of FWS, NMFS, EPA, DOE, Game, DNR, SCORP, PSCOG, and SCD. The parcel is managed by the Department of Game as a refuge, providing protection for all species using the area.

Development Pressure

The area is presently wetland open space. The surrounding land is used for agriculture. The area is not accessible by road. The entire par-

(Continued)

LOCATION: (13) Ebey Island, Washington
State Department of Game

cel is owned by the Department of Game. Tidelands in the area are state-owned. The entire area is zoned Agriculture 10 Acre (A-10), in which allowed uses are agriculture and residential units at one unit/10 acres. Development pressure on this parcel is negligible.

AREA OF IMPORTANCE

LOCATION: (14) Tulalip Bay

Total Acreage: 364

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *54 Bay	143		
2. *622 Algal (W)	55		
3. *623 Eelgrass (W)	19		
4. *624 Salt Marsh (W)	4		
5. *637 Sand-Silt Flats	40		
6. *638 Mudflats	100		
7. 711 Vegetated Spit	3		

History of Area

The lumber mill at Tulalip was the first major commercial activity in this area of the Snohomish River. It was purchased by the government in 1855, to become part of the Tulalip Reservation, and there has since been no lumber mill in the bay. Until recently, broad expanses of the mudflats were for log storage. At the north end of the bay is a hatchery which produces a sizable return each year.

Natural Functional Importance

This is the only protected saline bay within the study area. The Tulalip Hatchery is an important producer of steelhead which are harvested as both a sport and commercial fishery. The mudflats inside Tulalip Bay are probably inhabited by abundant populations of sediment dwelling detritivores. These organisms are an important food source to both juvenile salmon and other fish, and also shorebirds such as dunlins and sandpipers. In addition, some dabbling ducks such as mallards and shovelers also feed on the detritivores. The small fish that feed here are an important food item to herons, grebes, mergansers, and other fish-eating birds. The spit at the mouth of the bay is an important resting area for shorebirds and waterfowl, offering considerable security. The spit also acts as a wave break, protecting the bay shoreline from wave attack.

Ancillary Importance

The Tulalip Reservation Comprehensive Plan recommends the protection and conservation of the natural assets of the reservation, including fish and wildlife and recreational opportunities; this area is a habitat for various species and is a recreational location. The

(Continued)

LOCATION: (14) Tulalip Bay

Tulalip Tribes have accepted the Snohomish County SMP for this area, which designates the tidelands Conservancy and the shoreland Suburban. There are archeological sites and the tribal potlatch grounds along the Tulalip Bay shore. The Marysville School District uses the Tulalip Bay area for educational field trips to study intertidal flora and fauna. Because of its value as wildlife habitat, the area is under preservation policies of FWS, NMFS, EPA, DOE, DNR, Game, and Fisheries.

Development Pressure

The area is an open space sand spit, with associated tidelands. The land around the bay is used for residential development, and there are undoubtedly recreational opportunities for residents near this area. The area is quite accessible on foot from the nearby roads. The reservation land use plan shows residential development along the shores of Tulalip Bay. A large marina complex (500 moorages) is planned in the southeast portion of the bay. The area is either owned by the Tulalip Tribes or by private owners of the surrounding residences. Development pressure on this area is considered low except for the area of the planned marina complex.

AREA OF ENVIRONMENTAL CONCERN

LOCATION: (15) Entrance Mudflats

Total Acreage: 470

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *1532 Log Rafts	254	--	
2. *511 Estuarine River	8	--	
3. *62 Aquatic Land	3	--	
4. *622 Algae(W)	2	--	
5. *6241 Sedge Marsh(W)	2	--	
6. *638 Mudflat	201	--	

History of Area

There has been no diking of these exposed flats. Continuous use for log rafting has severely decreased the predominantly secondary productivity. Construction of training dikes, jetty and breakwater may have altered sediment deposition patterns.

Natural Functional Importance

Intertidal flats such as these are highly productive as an important habitat for invertebrate benthos. Benthic organisms are an important food source for salmon, shad, shorebirds and some waterfowl. These areas are used by juvenile salmon for feeding and schooling. Shad also use the flats for a feeding and nursery area. Water flows across these flats to enter the sloughs, thus currents, salinity, and flushing are controlled in part by the configuration of these flats. Although the flats are heavily impacted by lografting, research indicates a quick recovery after removal of the logs.

Ancillary Importance

The southern portion, west of Smith Island, is in Snohomish County and is designated Conservancy in the SMP. It is recommended for preservation by the Snohomish River Basin Mediated Agreement. The northern portion, between North Ebey Island and Priest Point, is within the Tulalip Reservation boundaries; its shoreline designation is undetermined. The entire area is in the non-disposal area in the Port of Everett's Consensus Guidelines. As a highly productive habitat and fish migration route, this area falls under preservation policies of FWS, NMFS, EPA, DOE, DNR, Fisheries, and Game. PSCOG has a policy that publicly owned tidelands should be retained in public

(Continued)

LOCATION: (15) Entrance Mudflats

use. This area is critical habitat and migration route for commercial species.

Development Pressure

The southern area is extensively used for log rafting and has pilings throughout. Nearby land areas have forest products industry and/or have been filled. The area is accessible by boat. The southern portion is privately owned; the northern portion is on the Tulalip Reservation. Development pressure for activities other than continued piling/log rafting is considered low.

AREA OF ENVIRONMENTAL CONCERN

LOCATION: (16) Ebey Island, A, B, C, D

Total Acreage: 273

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. 42 Broadleaf Forest	22	3	
2. 43 Mixed Forest	3	4	
3. 612 Fresh Swamp(W)	248	33	

History of Area

This area is made up of three parcels on Ebey Island. The island was diked after 1895 but before 1941. Most of these areas have not ever been logged.

Natural Functional Importance

The swamps are highly productive habitat types. This diverse wooded area provides breeding, feeding and resting habitat for many varieties of wildlife, including raptors, songbirds, birds, deer, mink, raccoon and numerous small to medium size mammals. Many species may use this habitat for one aspect of life and the intertidal estuarine habitat for other aspects. Raptors and other carnivores may nest here and feed on rodents in neighboring agricultural areas.

Ancillary Importance

Shorelines of these areas are designated Rural under Snohomish County's SMP. All these areas are within the non-disposal area under the Port of Everett's Consensus Guidelines. As valuable wildlife habitat, they fall under general preservation policies of FWS, NMFS, EPA, DOE, Game, DNR, SCORP, PSCOG, and SCD.

Development Pressure

All these areas are presently wetland open space. The surrounding land is used for agriculture. The smaller areas are accessible by road. Ownership varies from area to area; some are under one ownership. Tidelands in the area are state-owned. The entire area is zoned Agriculture 10 Acre (A-10), in which allowed uses are agriculture and residential units at one unit/10 acres. Development pressure is slight on the smaller inland parcels, but somewhat higher on the parcel on the west bank of the Snohomish River (there is a possibility that some of this area may be filled).

AREA OF ENVIRONMENTAL CONCERN

LOCATION: (17) Cavalero Corner

Total Acreage: 42

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *6111 Spruce Swamp(W)	17	6	
2. *6112 Shrub Swamp(W)	17	8	
3. *6260 Freshwater Marsh(W)	8	27	

History of Area

Most of the area shows no evidence of disturbance except construction of a highway along the upland boundary. The southern 8 acres was originally part of the agricultural area to the south. The dike between the southern portion and the agricultural area was constructed between 1969 and 1974.

Natural Functional Importance

Both marsh and swamp habitats are highly productive. Marsh provides nesting and feeding habitat for songbirds, small mammals and some shorebirds such as bitterns. The diverse swamp communities provide feeding and nesting habitats for a wide variety of mammals and songbirds. Waterfowl feed and nest along the breached dikes bordering the area. Raptors nest and rest in spruces. In conjunction with the Washington Department of Game property immediately across the slough, creates a major ecosystem. The area provides some floodwater storage.

Ancillary Importance

This area is designated Conservancy in Snohomish County's SMP. As a valuable waterfowl habitat, it falls under general preservation policies of FWS, NMFS, EPA, DOE, DNR, Game, SCORP, PSCOG, and SCD. The area provides a pleasing view from the road and buildings to the east.

Development Pressure

The area is wetland open space with agriculture to the north and south, development to the east, and the Game Department's large parcel to the west. It is readily accessible on foot from the road. The area is in small ownerships and is zoned Agriculture 10 acres (A-10) which per-

(Continued)

LOCATION: (17) Cavalero Corner

mits agriculture and residential development at one unit/10 acres. Tidelands in the area are state-owned. Development pressure is slight because of the floodplain location and the shape of the area (it is long and very narrow).

AREA OF ENVIRONMENTAL CONCERN

LOCATION: (18) Lowell

Total Acreage: 28

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *6112 Shrub Swamp(W)	14	6	
2. *6253 Cattail Marsh(W)	14	39	

History of Area

The first lumber mill in Everett was located immediately south of this area. This area was also the initial Pacific Coast terminus of the Great Northern Railroad. The Everett Pulp and Paper Mill was located along the southwestern edge of this area until about 1970. This area was diked, but the dikes are now breached. Dates of construction and breaching are not known. The adjacent area between railroad tracks was filled by 1974. This area is substantially impacted by runoff from developed and urbanized areas upstream.

Natural Functional Importance

Cattails are highly productive. They provide feeding and nesting habitat for a variety of songbirds and small mammals. The marsh is the only site in the estuary known to be inhabited by beaver. The swamp is a diverse community which provides nesting and feeding habitat for a variety of furbearers, small mammals and songbirds. Raptors nest and rest in trees along the old dike. The area provides some floodwater storage. Urban runoff through this marsh is slowed down significantly, allowing sedimentation of suspended solids before the runoff enters the river.

Ancillary Importance

As a highly productive habitat and the only known beaver habitat in the estuary, this area falls under general preservation policies of FWS, NMFS, EPA, DOE, DNR, Game, SCORP, PSCOG, and SCD.

Development Pressure

The area is wetland open space, with the surrounding land in industrial (forest products) use and a railroad. The Snohomish River at this point is used for log storage. The area is accessible from the

(Continued)

LOCATION: (18) Lowell

railroad line and from the industrial area to the south. The area is in the city of Everett and is designated Urban in Everett's SMP. This area is part of Everett's industrial Area III; the City's stated policy is that the preferred location for future water related new industry should be in Area III along the west bank of the Snohomish River from Pacific Avenue south to Lowell. There is a proposed dredge disposal site at the southern end of this area. In the Port of Everett's Consensus Guidelines, the Port acknowledges the need to encourage private development of and/or seek public acquisition of the Lowell Industrial Site (at the south end of this area) for development and deposition of maintenance dredge materials. The tidelands along this area are mostly state-owned. The area is clearly planned for industrial development by the City of Everett. Development pressure is high here.

AREA OF ENVIRONMENTAL CONCERN

LOCATION: (19) Weyco Islands

Total Acreage: 20

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. 311 Meadow	.4	100	
2. 321 Successional Shrub	1.6	<1	
3. 42 Broadleaf Forest	7.7	1	
4. *6112 Shrub Swamp(W)	1.4	<1	
5. *6250 Brackish Marsh(W)	2.0	10	
6. *6252 Cattail/Bulrush Marsh(W)	5.7	<1	
7. *6254 Sedge Marsh(W)	.4	1	

History of Area

About 8 acres of the northern island has been used for dredge material disposal since 1969. Other than this there has been no known development activity on the islands.

Natural Functional Importance

The cattail/bulrush marsh is highly productive. This marsh provides feeding and nesting habitat for songbirds and small mammals. The sedge marsh is also highly productive. The sedge is an important food source for some waterfowl. The close proximity of marsh, swamp and forest allows all three habitat types to be used by small mammals. Hawks have been identified as nesting in the forest habitat. The isolation of the islands creates a sanctuary for birds which use them.

Ancillary Importance

The islands are in the city of Everett and are shown as a future park in Everett's park plan. Everett already has Wiggums Hollow park just to the southeast. As a productive wildlife habitat, the area is under preservation policies of FWS, NMFS, EPA, DOE, DNR, Game, SCORP, PSCOG and SCD

Development Pressure

The area is meadow open space with a small amount of wetland. The

(Continued)

LOCATION: (19) Weyco Islands

river around the islands is used for log rafting. To the west of the river the land is in industrial (forest products) use. The Everett sewage lagoons are to the east. The area is only accessible by boat. The islands are designated Urban in Everett's SMP. The tidelands around the islands are privately owned. There may be pressure to develop this area, as part has already been filled and it is near existing industrial uses. However, its relative inaccessibility may restrict the type of development which would occur.

AREA OF ENVIRONMENTAL CONCERN

LOCATION: (20) Maulsby Mudflats

Total Acreage: 165

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *638 Mudflat	57		
2. *1532 Log Rafts	108		

History of Area

These mudflats are a portion of what was a continuous shoreline of mudflats from Preston Point to the south end of the Port of Everett. Since 1900 most of these flats have been used for log storage. Several portions of these flats have been filled for use as wharfs or industrial sites.

Natural Functional Importance

This area has the potential for abundant detritovore production (log storage activities tend to inhibit that production at present). Detritovores are a major food source for juvenile salmon and flatfish, herring and other small fish. They are also the prime food for sandpipers, dunlins and other shorebirds. Herons, grebes and other fish eating birds often feed over these mudflats when the tide is right. These open flats allow adequate flushing of Maulsby Swamp and probably use much of the detritus exported from that area.

Ancillary Importance

The area is in the city of Everett and the Port of Everett. Everett's Community Plan has policies to prohibit filling of tidal flats, encourage log storage on land sites, and locate new water-related industry in the Lowell area. These mudflats are of expressed concern to USFWS, NMFS, and EPA; these agencies view the area as a productive mud salt marsh which should be preserved. As a potential fish and wildlife habitat, the area will be of concern to DOE, DNR, Fisheries and Game.

Development Pressure

The area is presently used for log storage. It is located in the main port waterfront area and the surrounding land and water uses are all industrial and port-related. Fills have already occurred to the north and south of this area. The mudflats are easily accessible

(Continued)

LOCATION: (20) Maulsby Mudflats

from the port areas and from the road. Urban services could readily be extended from existing developed areas. Everett's SMP shows the whole port waterfront as Urban. A dredge material disposal site is proposed on these mudflats by the Port. The Port's Consensus Guidelines support the placing of dredge materials on areas identified for development in the central waterfront. Although the area is in the Port central waterfront, it is privately owned. The Port has indicated possible future acquisition and expansion in this area. Development pressure on this area is high; there is an existing permit application to fill about 11 acres at the north end of the mudflats adjacent to the existing fill. No action has yet been taken on this application. Development pressure on the area will continue to be high, because of its location and the policies directing development toward the central waterfront.

AREA OF ENVIRONMENTAL CONCERN

LOCATION: (21) Dikes of Concern

Total: 42 miles

<u>Habitat Types</u>	<u>Acreage at Location</u>	<u>% of Total type in Estuary</u>	<u>Remarks</u>
1. *6254 Sedge Marsh(W)			
2. *6253 Cattail Marsh(W)			
3. *6112 Shrub Swamp(W)			
4. *6111 Forested Swamp(W)			

History of Area

The construction of most of the dikes in the study area occurred between 1884 and 1910. Since their initial construction many of these have been breached during storms and floods. Occasionally, such as on North Ebey Island, the breaches were not repaired. In other cases a new dike was constructed inside the older one. On top of some dikes a roadway is maintained, on others the vegetation is completely overgrown. In recent years, maintenance and repair have used riprap construction.

Natural Functional Importance

The vegetated dikes provide a unique and valuable habitat for wildlife. This is particularly true where one or more old dikes are located on the slough side. The habitat along the dikes is a series of narrow zones of brackish marsh, brackish swamp, water and riparian shrub habitat types. This dense and diverse vegetation provides feeding areas for waterfowl, songbirds, and shorebirds. Small mammals and muskrats nest on the dike banks as do some waterfowl. Songbirds are common nesters in the shrubs and trees. Carnivores and raptors may find suitable nesting sites and abundant food in these narrow vegetated zones. In addition, insectivorous birds and carnivores can easily enter adjacent agricultural areas to prey on insect and rodent pests. The dikes often create a buffer between the fauna-dominated slough and human-dominated upland areas, thus providing secure environment for nesting and feeding. The dense vegetation also helps protect the dike from erosion.

Ancillary Importance

The dikes on North Ebey Island east of I-5 fall in the preservation areas recommended in the Snohomish River Basin Mediated Agreement. Much of these dikes are in the non-disposal area under the Port of

(Continued)

LOCATION: (21) Dikes of Concern

Everett's Consensus Guidelines. Because of their value as wildlife habitat, the dikes fall under the general preservation policies of FWS, NMFS, EPA, DOE, DNR, Game and SCD. Most of the dikes are located along shorelines designated Rural, Conservancy, or Natural.

Development Pressure

The dikes are themselves a form of development, in that they are artificially created to allow a change in the area they protect. In most of the floodplain, the dikes protect agricultural and rural uses. Where the dikes have breached, as on North Ebey Island, the area within has reverted to wetlands. The dikes provide accessibility to some areas, in that vehicles can often drive along the top of the dikes. Where the dikes are along shorelines designated Urban, the dikes may be changed themselves or they may protect urban development. Diking districts, of which there are 5 in the estuary floodplain (Plate 19), are responsible for construction and maintenance of the dikes. These districts are formed of estuary land-owners and whether the dikes are maintained depends on the desires of these owners. The diking districts have eminent domain rights. The dikes have the same zoning as the land they protect. Development pressure on dikes of concern is low, except for pressure to maintain the dikes and possibly to repair breached dikes.

C. THE IMPACTS OF PERMITTED ACTIVITIES IN THE
SNOHOMISH ESTUARY STUDY AREA

1. This section discusses the major types of activities requiring Corps permits in the Snohomish estuary study area and the impacts of these activities on the physical and biological estuarine systems. The purpose of this section is two-fold.

- . To provide general information on the types of impacts associated with particular activities and a summary matrix showing the types of impacts which can result from the various activities, to allow a rapid qualitative assessment of an activity.
- . To describe an approach for the assessment of the environmental effects of a proposed permit activity in a given location in the study area.

2. There are 30 activities which are listed on Corps permits in the study area. Of these 30, four account for over 60% of the total non-cancelled permit activities since 1972. These four are dredging, fills, piling and dolphins, and bulkheads. Other activities less frequently listed but still significant in number include piers (commercial and non-commercial), floats, buoys, booms, and dredge material disposal.

3. Some of these activities are closely related to common uses of the area. For example, the placement of pilings and dolphins in the study area is related to log storage in open water or intertidal areas. Log storage is a very common water use in the Snohomish estuary and Port Gardner, as shown in Table VII-7, Public and Land Profile, Section VII, Volume II. Non-commercial piers are related to recreational boating, as are marinas.

4. Environmental impacts may be related to construction and/or operation of the use or activity. The impacts may be short-term or long-term. There may be secondary activities, such as increased commercial growth induced by new industrial development on a filled area or increased boating activity associated with the placement of mooring buoys. Secondary activities will have environmental impacts which must be considered at least qualitatively in the evaluation of the primary activity.

5. An issue of great importance in evaluation of permit applications is that of cumulative impacts of permit activities on the study area. Cumulative impacts can be defined as those impacts resulting from the implementation of pending or future permit appli-

cations in the study area. More specifically, the term "cumulative impact" may have either or both of the following meanings:

- . The continued loss of or encroachment on wetlands in the study area and the consequent loss of a valuable resource.
- . The environmental degradation of the study area resulting from the additive effects of activities of the same type or of activities with the same types of impacts.

6. The first meaning may be amplified as follows: If there are five pending permit applications which contain requests to fill wetland areas in the estuary, what will be the total loss of wetlands in the estuary and what will be the loss in wetland acreage by type if these permits are granted? What is the value of these wetlands in terms of natural functional characteristics and ancillary issues of the public interest? How much of the wetlands resource will remain?

7. The second meaning may be amplified as follows: How much activity (for example, boat slips) can the area support without significant degradation of water quality, air quality, the ambient noise environment, and so on? If there are five pending permit applications for marinas, what will this mean in terms of additive water pollutant loading, for example?

8. The following discussion describes each use or activity and the physical, chemical, and biological impacts it may have on the environment of the study area. A judgment of general impact potential is made. Secondary activities which might occur as a result of each use or activity are listed. References, such as Section VII, refer to sections of Volume II.

1. Uses, Activities, and Impacts

The uses and activities described here include: dredging; dredged material disposal, fill, and dikes; piers and docks, pilings, and dolphins; bulkheads; floats, buoys, booms; log storage; marinas; outfall structures; breakwaters, and in-water construction of large marine facilities. Section 10 permits are required for any of the above activities in navigable waters. Section 404 permits are specifically for the discharge of dredged or fill material into waters and adjacent wetlands of the United States. Any activity which involves such discharge, for example the construction of a fixed breakwater on fill, will thus require

a Section 404 permit as well as a Section 10 permit. In addition to the above activities, secondary activities and impacts, and cumulative (additive) impacts are discussed.

Dredging

Description: Dredging is the removal from a water body of either original or recently deposited bottom material. From Corps regulations (33 CFR 323.2) dredged material is defined as material that is excavated or dredged from waters of the United States. New dredging is usually associated with construction of moorages, marinas, and piers. Maintenance dredging is done to keep navigation channels and mooring areas open for navigation; in the study area maintenance dredging is done in the settling basins in the waterfront area of Port Gardner and in the Snohomish River north of Highway 2. Once an area has been dredged, it usually must be periodically dredged to maintain it.

Dredging in the study area is most frequently done by clamshell (hopper, bucket) dredge or by hydraulic pipeline dredge; however, Hoffman (1978) describes seven less well-known methods which may be useful in circumstances requiring particular environmental controls or dredging techniques.

Physical Effects: The primary (but not necessarily the most important) physical effects of dredging are the creation of deep holes or channels which change the hydraulics in the vicinity, and the temporary suspension of clouds of sediments, causing turbidity in the water body. The finer the sediment, the higher the resulting turbidity. In the study area finer grained sediments (silts and muds) are found in Ebey Slough north of Otter Island, in Union Slough, and in the Port Gardner area. Dredging in these areas would create more turbidity than in the areas of the estuary with sandy or gravelly bottoms (Plate 8). Different methods of dredging result in more or less turbidity; a hydraulic pipeline dredge stirs sediment at one location (the cutterhead) during dredging, while the hopper dredge stirs sediment at three locations (the prop wash, the suction heads, and the hopper overflow ports). The sediments suspended in the water column may settle out downstream, creating a new sediment layer on the bottom.

Chemical Effects: Dredging breaks through the thin oxidized layer of the submerged soil and exposes the unoxidized layer. The sediments placed in suspension are also chemically reduced. The exposure of these reduced sediments creates a high chemical and biological oxygen demand. In the Snohomish estuary dissolved

oxygen levels vary seasonally and through tidal cycles. The estuary substrate has high organic content and a shallow reducing layer.

If the dredging is done in an area where dissolved oxygen concentration is low and flushing is poor, or where there is a very high concentration of oxidizable substance in the exposed materials, dissolved oxygen concentrations may be significantly reduced. In the Snohomish estuary study area, however, dissolved oxygen levels have been found to be generally within standards even in poorly flushed areas such as Ebey Slough (except in Everett Harbor, where dissolved oxygen is often below standards).

Dredging may expose toxic materials such as hydrogen sulfide, organic compounds, and heavy metals which have been discharged as industrial wastes and absorbed and buried in the sediments. Such discharges have occurred in Port Gardner (sulfite discharges from the pulp mills) and historically in the Lowell area; however, pulp mills in Port Gardner have significantly reduced the sulfite discharges in recent years (Water Quality, Section VI).

Biological Effects: Dredging may destroy or adversely affect flora and fauna in the water and aquatic lands habitats of the study area. The water and aquatic lands habitats contain a variety of flora, including phytoplankton, algae, eelgrass, and marsh plants (Flora, Section VI). The rivers and sloughs are spawning and juvenile nursery areas for salmon, shad, and other fish (Fish, Section VI). Clams, crabs, cockles, and sediment dwellers (worms and crustaceans) are all found in the mudflats at the mouth of the river, inside the Port of Everett, west of Jetty Island and along the slough sides and bottoms. Insect larvae are found in all marsh and swamp habitats (Shellfish and Other Invertebrates, Section VI). Dredging destroys the benthic habitat and with it the associated eelgrass, algae, and the benthic organisms such as clams, worms, and crustaceans. Recovery time may be fairly short (two to three months) as has been observed for recovery from the effects of log rafting (see below); however, this will be dependent on season, sediment composition, and rate of deposition and numerous other factors.

An excellent general discussion of the biological effects of suspended sediments, increased turbidity, sedimentation, changes in oxygen concentrations, and toxic materials is contained in Darnell (1976, pp. 234-270). More detailed information on the effects of maintenance dredging (and disposal) on aquatic vegetation, fish, avian and mammalian fauna, ecological relationships, juvenile salmonids, and crabs may be obtained from the

Corps of Engineers study in Grays Harbor, Washington, published in 1976-77. In general, turbidity and suspended sediments interfere with primary productivity (photosynthesis), respiration, feeding and nutrition, and migration and spawning. Sedimentation may smother eggs, larvae and adult forms of benthic fauna and fish. Changes in dissolved oxygen may suffocate aquatic plants and animals, and toxic materials may kill or be absorbed by flora and fauna.

Impact Potential: Medium

Secondary Activities: Dredged material disposal and fill, navigation and placement of navigational aids, marina construction and operation, port development and expansion.

Disposal of Dredged or Placement of Fill Material, Dikes

Description: From Corps regulations (33 CFR 323.2), dredged material disposal, or the discharge of dredged material, means any addition of dredged material into the waters of the United States. The term includes, without limitation, the addition of dredged material to a specified disposal site located in waters of the United States and the runoff or overflow from a contained land or water disposal area. In the Snohomish estuary study area, very little disposal of dredged material is done in the open water; there is only one deep water disposal site which is located near the southwestern corner of the study area (Plate 17). Thus, most dredged material disposal in the study area is on uplands. Fill material is material used for the primary purpose of replacing an aquatic area with dry land or of changing the bottom elevation of a waterbody. Discharge (placement) of fill material is the addition of fill material to waters of the United States, including adjacent wetlands (33 CFR 323.2). Sometimes an area may be filled primarily to dispose of the material (for example, the Tulalip fill). For purposes of discussing environmental impacts, dikes may be considered a form of fill in that they are placed on and around wetlands to prevent continued water intrusion. The protected area (and the dike) are then useful for other purposes. In the study area, locations of known fill are shown on Plate 12. Sites of dredged material disposal (past, present, and proposed future) are shown on Plate 17. Fill materials used in the study area include sand and gravel dredged from the river and harbor, wood wastes, including chips, sawdust, bark, and "hog fuel" (wood and trash). The Tulalip fill is the only municipal waste fill in the estuary. Typical wood waste fills are the dikes on Spencer Island South. Riprap is sometimes used to protect dike

banks. Discharge of dredged or fill material requires a Section 404 permit.

Physical Effects: Fills and dikes interfere with the surface flow through the wetland by blocking it off (or covering it) from water interaction. This may change flow characteristics of the estuary; for example, the diking of large portions of the study area resulted in the faster movement of a unit of water through the estuary, since it was forced into unimpeded channels and removed from wetland interaction. A result of this is reduced areas for floodwater storage and perhaps higher flood heights downstream. Fill banks may tend to erode and in some cases need to be protected. The area filled is raised above its former elevation, and this will induce biological changes. Storm runoff may be different (faster) and may result in short-term salinity fluctuations in the area around the fill.

Chemical Effects: Fill materials may produce water quality problems if leachate from the fill enters the river and sloughs of the estuary. Wood waste fills and fills composed of municipal wastes (sanitary landfills) produce leachate containing substances which may be toxic to aquatic organisms. Depending on the composition of dredged materials, their disposal may result in leachate problems if they are used for fill. Sand, gravel, and clean earth do not produce toxic leachate. Dissolved oxygen levels may be lowered at the site where discharge of dredged or fill material occurs.

Biological Effects: The immediate biological effect is the loss of the existing habitat at the fill site. If it is a marsh or swamp habitat, filling it will mean the loss of a highly productive area. All vegetation and soil or sediment dwellers in the filled area will be lost. Vegetation may ultimately regrow in the filled area, but it will be different from the original vegetation because of the difference in elevation and drainage characteristics. There is considerable interest in the use of dredged material to create new marsh habitats by placing it as fill on intertidal areas (Bee-man and Benkendorf, 1978; Reimold, 1978; Eckert, 1978; Smith, 1978). Marysville has a specific policy calling for dikes to be located landward of swamps, marshes, and other wetlands associated with the river.

Any habitat will usually be at its carrying capacity for the species using it. If a significant amount of the habitat is lost by filling, there may be a resulting loss in the numbers of fauna in the estuary, unless they can use the newly created habitat as well. If the habitat is specialized, particular species may be eliminated. For example, filling of the Lowell

marsh area would eliminate the only known beaver habitat in the study area. There do appear to be other areas suitable for beaver habitat, but the animals may find migration too difficult.

Some filled areas, for example, dikes in the estuary, provide a valuable habitat. When riprap is placed on the dike face, it eliminates this habitat. Diking an area converts that area from wetland to upland, thus causing a loss of wetland-type habitat. There is some trade-off value in the creation of the dike habitat. Unlike filled areas, diked areas may revert to the original wetland habitat if the dikes are allowed to degenerate through lack of maintenance.

If the filled area produces toxic leachates, flora and fauna may be killed. Changes in salinity from increased runoff may affect flora and fauna around the fill.

Impact Potential: High

Secondary Activities: In filled areas, secondary activities may include industrial, commercial, residential, or any other form of intensive development. In diked areas, land uses such as agriculture are often in the protected area behind the dikes. In general, filling and diking serve to create land which may be used for development of various types.

Piers and Docks, Pilings, and Dolphins

Description: A pier or dock is a structure, usually of open construction, extending from the shore out into the water, designed to serve as a mooring place for boats. Pilings are long, heavy timbers driven into the bottom and protruding above the water surface. A dolphin is a cluster of piles bound together. In the study area, the most common use of pilings and dolphins is in log rafting areas, for controlling the rafts.

Piers and docks in the study area are located generally in the Port Gardner waterfront area, in Tulalip Bay, along the Snohomish River, and along the sloughs near I-5. Where there is residential development (Plate 12) there may be small single-family docks. Pilings are located in Port Gardner, in Tulalip Bay, and in the entrance mudflats where extensive log rafting is done. Pilings are also located along the Snohomish River and parts of Ebey, Steamboat, and Union Sloughs. This discussion does not cover log rafting effects; they are described further on.

Physical Effects: The placing of pier supports or pilings may cause some turbidity if the bottom sediments are fine-grained, as is the case in Ebey Slough north of Otter Island and in the Port Gardner area. The effect is small and temporary. A very small area of bottom for each piling or support would be affected.

Chemical Effects: None of these structures has any significant effect on water quality; however, activities such as log rafting or boating which use the structures may adversely affect water quality (secondary impact).

Biologic Effects: Pilings have minimal effects in and of themselves on the biological environment. Both pilings and pier supports can provide a suitable substrate for algae, attachment sites for invertebrates (barnacles, mussels, etc.), cover and feeding sites for fish, and sites for perching birds.

Piers can have more major effects on biological systems, primarily because of shading effects. Growth of wetland or tideland vegetation (algae, eelgrass, marsh vegetation) may be impeded or eliminated because of decreased light. Local turbidity and sedimentation may be increased because of changes in local currents, affecting fish and benthic fauna.

Impact Potential: Low

Secondary Activities: Vessel moorage, log rafting, various types of development (industrial, commercial, residential) depending upon the size and ownership of the pier or dock.

Bulkheads

Description: A bulkhead is a structure or partition designed to prevent erosion of the land behind it and/or to protect the upland from wave damage. They may be constructed of timber, steel, or concrete, and may be associated with all types of development. In the study area bulkheads are principally found in Port Gardner and along the Snohomish River west bank near the Weyerhaeuser Mill. Bulkheads require a Section 404 permit.

Physical Effects: Turbidity in the water column will be temporarily increased during construction, particularly in fine-grained areas (see Dredging for effects of increased turbidity). The structure is an abrupt vertical wall which may extend into relatively deep water to allow boat mooring. The vertical face of the structure creates reflection waves in shallow water which

may further disturb sediments and/or erode the foreshore. This would be a minor problem in sheltered areas with low wave action (such as inside the estuary). Effects of activities associated with bulkheads (such as boat moorage) are secondary effects not described here.

Chemical Effects: Bulkheads have little chemical effect on water quality. If the bulkhead eliminates marsh area, then any water purification characteristic of the marsh will be eliminated.

Biological Effects: The construction of the bulkhead permanently buries established terrestrial and intertidal vegetation. If the bulkhead is constructed in a wetland, it will eliminate the natural habitat there; if it is constructed landward of the wetland growth, the fringe marsh area will be preserved but may be impacted by increased freshwater runoff or erosion. Bulkhead construction in wetland areas may affect all fauna using the wetland, including birds and mammals. For mammals, the bulkhead may eliminate access from the aquatic area to the upland, thus limiting use of the seaward habitat.

The newly created deep water zone in front of a bulkhead may have a lower concentration of detritus, lower phytoplankton production, and fewer benthic organisms than unbulkheaded areas. Turbulence from reflected wave action may prohibit vegetation growth. Bulkheads cause an abrupt habitat change, eliminating shallow water areas. Salmon fry may go into deeper water when confronted with a bulkhead or congregate near the bulkhead, not going around it. Both circumstances make the fry vulnerable to predation.

Impact Potential: High

Secondary Activities: Industrial, commercial, and residential development, or any type of on-shore development needing protection. Bulkheads may be built to allow boat moorage.

Floats, Buoys, Booms

Description: A buoy is an anchored or moored floating object intended as a navigational aid, for vessel moorage, or to mark an underwater object. A floating platform is held in place by anchors or other moorage and may be used by boaters or swimmers. A boom is basically a floating log, moored at each end, the purpose of which is to enclose an area of water.

In the study area, booms are moored between pilings whenever they are being used for log rafting and storage. Floating breakwaters are designed to smooth wave action in the area behind the breakwater; they are similar to floating platforms.

Physical Effects: Physical effects of buoys are minimal. Floating platforms, booms, and breakwaters may create smooth water and so protect and shelter areas behind them.

Chemical Effects: These structures have negligible chemical effects on water quality.

Biological Effects: There may be shading effects of floating structures; these are usually small. Floating structures may provide habitat for sessile organisms and cover for fish.

Impact Potential: Low

Secondary Activities: Boating and navigation, recreational water use, log storage and log rafting.

Log Storage or Log Rafting

Description: Log storage or rafting is the storage of logs in the water or intertidal mudflats and marsh in the study area. The logs are often stored for long periods of time. The amount of storage area covered by logs at any one time varies greatly depending on the intensity of logging activities and pulping operations. In the study area, log storage occurs on the Maulsby mudflats in the Port waterfront area, on the entrance mudflats west of Smith, Spencer, and North Ebey Islands, in the Snohomish River as far south as Lowell, and in the northern part of Union, Steamboat, and Ebey Sloughs. As shown in Table VII-7 (Section VII), there were about 720 acres of water or intertidal area devoted to log storage in 1977. Log rafts stored in intertidal areas are usually above water and lying on the substrate once a day. Smith (1977) conducted an extensive study of the effects of log rafting in the Snohomish estuary; the following discussion is taken from his work.

Physical Effects: Log rafts make large areas of the water surface unavailable for any other use. The storage areas do not generally accumulate much bark on the bottom, unlike log dumps or handling sites (where the logs are bundled and lowered into the water). However, the sediments do have a somewhat higher organic content than in non-rafting areas. When log rafts ground on the substrate, they squeeze and compress

the substrate, creating a series of troughs and ridges. The log rafts knead the substrate into different ridges each time they settle.

Chemical Effects: Water quality around the study area log rafts is generally good, with turbidity low and dissolved oxygen relatively high. However, log rafts may leach lignins and tannins, and release floatables such as bark or wood debris.

Biological Effects: Log rafts which settle on the substrate at low tides greatly reduce the number of species of the benthos, and the species abundances. In some cases, a particular taxon of benthic invertebrates was completely eliminated; these included the crustaceans, Corophium salmonis and spiniacorne, among others (Smith, 1977). In 10 out of 11 cases, the benthic fauna tested were significantly reduced. The time interval required to seriously damage the benthos is probably only a few days. Interestingly, this is a relatively short-term effect; if log rafting is stopped, the recolonization period for the return of the complete range of benthic invertebrates is about two months (observed in the study area, Smith, 1977). Recovery time may depend on season.

Log rafts, stored in water areas where they do not ground, shade these areas and thus reduce aquatic vegetation.

Impact Potential: High, except that the recovery time for recolonization of the area by benthic invertebrates is short once the rafts are removed.

Secondary Activities: Forest products industry (pulp mills, sawmills, lumber yards, and so on), supporting commercial development, navigation.

Marinas

Description: Marinas are areas providing docking space, water access, and harbor area for small boats. In the study area, marinas are located in the waterfront area of Port Gardner, on Spencer Island, and on the north shore of Ebey Slough near Marysville. A marina on Smith Island is under construction, and there are plans for a 500-boat marina complex in Tulalip Bay. A marina may be a somewhat open dock in a generally sheltered area such as Port Gardner, or it may be in a small protected harbor (sometimes artificial) as on west Spencer Island and in Marysville. Marinas may require a Section 404 permit if discharge of fill material is involved in the construction.

Physical Effects: If an artificial harbor is created, maintenance dredging must often be done (see Dredging above). The construction of breakwaters, groins, and jetties for marina protection may change hydraulic characteristics of the area.

Chemical Effects: The buildup of fouling communities (growth of mussels, amphipods, barnacles, etc. on floats and pilings) exerts a significant oxygen demand on marina areas. If circulation and flushing are poor, the low dissolved oxygen levels may result in problems for aquatic fauna and buildup of any water pollutants may occur. Harbor water tends to be warmer, and observations in Washington State indicate that pink and chum salmon fry tend to congregate inside marinas.

Without proper control over waste discharge, marinas may produce sewage type wastes, oil and grease, and litter. Shellfish beds located near marinas are considered potentially unfit for certification by the State Department of Social and Health Services. Fish may also be affected by water quality degradation.

Biologic Effects: Nixon et. al, (1973), compared a marina area and a salt marsh cove to evaluate marsh grass productivity, suspended particulates, phytoplankton, nutrients, bacteria, dissolved organics, copper levels, fish, and sediments. No major differences were found except for higher copper levels in the marina cove and greater abundance of fish in the marsh cove. However, another study showed a drop in benthic population in the area one year after construction of a marina.

Impact Potential: Medium to High

Secondary Activities: Recreation and boating, commercial development, on-shore traffic and parking.

Outfall Structures

Description: An outfall is a pipe extending into a body of water to discharge wastes such as storm water runoff, treated sewage effluent, or industrial wastes. In the study area, all three types of wastes are discharged. Storm water runoff discharges are located in all parts of the study area. There are three sewer lagoons discharging to study area waters; the discharges are in Ebey Slough south of Otter Island (Lake Stevens lagoon), in Ebey Slough near Marysville (Marysville lagoon), and in the Snohomish River near Weyco Islands (Everett lagoons). There are many industrial discharges in the study area including lumber mills, food processing plants, and pulp

mills; among the most notable are the discharges of the Everett pulp mills. The Scott Mill discharges most of its sulfite waste liquors through a deep water diffuser 700-800 meters offshore and 100-120 meters deep in Port Gardner. Another mill pumps effluent to settling ponds on Smith Island where it undergoes secondary treatment. The treated effluent is discharged to Steamboat Slough on ebb tides. If the construction of the outfall structure requires discharge of fill material, a Section 404 permit will be required.

Physical Effects: The physical act of discharge may cause local turbidity and changes in substrate. The outfall construction would cause temporary effects.

Chemical Effects: The major effect of an outfall is the impact of the discharge on water quality. Urban storm water runoff contains oil and grease, coliforms, heavy metals, suspended solids and other pollutants. Sewer lagoon effluent also contains coliforms. In the estuary, agricultural sources of runoff add pollutants such as coliform, fertilizers, and pesticides to receiving waters. The industrial waste discharges may contain sulfites, organics, calcium, and other organic and inorganic substances. The level of impact depends on the type of discharge and the quality of receiving waters.

Water quality in the study area has improved greatly in the past few years (Water Quality, Section VI). At present dissolved oxygen, temperature, and pH are within standards in the estuary. In the Snohomish River total coliforms are in excess of standards, but fecal coliforms are low. In Ebey Slough, water quality is generally good, with somewhat high total coliforms. The Port Gardner area had low dissolved oxygen in the past and generally low water quality because of the sulfite waste liquor discharges but it has now improved. Lowland agriculture does tend to adversely affect water quality, with water in ditches and floodways showing low dissolved oxygen, high phosphorus and high coliform levels.

Discharges of any pollutant in an area where that pollutant is already present in high levels may cause water quality standards to be violated. For example, new discharges of wastes high in coliform added to the Snohomish River south of the Everett sewer lagoons might mean more violations of standards downstream.

Biological Effects: The effects of the discharge depend upon the type of material discharged. Studies of benthic populations around the Seattle West Point Treatment Plant (a primary

treatment facility) showed no substantial differences before and after the outfall was operational. Most aquatic organisms will find industrial waste discharges such as sulfite liquors toxic (although gulls and waterfowl have been observed in the treatment ponds). If the discharge is located in a well-flushed area as is the West Point outfall, then effects on benthic populations would be small. Discharges into a low-flushing area such as Ebey or Union Slough may cause problems for aquatic flora and fauna.

Storm water outfalls on tidal flats and in wetland areas would affect flora and fauna. The discharges would have different temperature and dissolved gas content, and different salinity depending on location in the estuary. Organisms may suffer from the discharge load of urban type pollutants.

An outfall structure placed in a wetland will destroy the vegetation on which it is placed. The act of discharge may affect vegetation in the flow path. This is a minor impact. If the pipe blocks water interaction throughout the wetland, this would be a major impact.

Impact Potential: High

Secondary Activities: Industrial, commercial, or residential development.

Breakwaters

Description: A breakwater is a structure offering wave protection to a shore area, harbor, or basin. Breakwaters may be fixed or floating, shore connected or detached. The most notable example of a breakwater in the study area is the Jetty, a long breakwater protecting the Port of Everett waterfront. There are other breakwaters in the study area, notably in the entrance mudflats west of Smith and North Ebey Islands. All of these breakwaters are large and have been built for a long time. They are all fixed construction and detached from the shore. A fixed breakwater requiring fill needs a Section 404 permit; a floating breakwater would only require a Section 10 permit.

Physical Effects: Construction of a fixed breakwater is much like filling in its effects. Turbidity, destruction of habitat, flora, and fauna, and sedimentation are all effects of breakwater construction.

Breakwaters reduce wave energy in the area behind them. Solid breakwaters can decrease or change circulation, interfere with

tides and currents, and obstruct littoral drift. Toe scour can cause local turbidity and damage to the structure. Sediment compositions in the area inside the breakwater may change.

Chemical Effects: If circulation and flushing are impaired by the breakwater, adverse impacts on water quality may result.

Biological Effects: If sediment composition changes behind the breakwater, the benthic population may change in species distribution, diversity, and numbers. Breakwaters may affect fish migration routes; this has been documented in the Columbia River and coastal bays by the Washington State Department of Fisheries. If migration routes change, fish may be subject to increased predation.

Floating breakwaters generally have less severe environmental effects than fixed ones, and the Washington State Department of Fisheries generally recommends their use to protect fish resources (Washington State Department of Fisheries, 1971).

Impact Potential: High

Secondary Activities: Port and harbor activities, navigation and boating, marina development, other types of development.

Water Construction of Large Marine Facilities

Description: Large marine facilities are structures used for energy development (oil rigs and platforms), raw material processing, and marine terminals. Such facilities are constructed either in deep water or in graving docks (a construction pit below MLLW in which large structures are built; the pit is then flooded to float the structures. Examples of proposed activities of this type include:

- . A marine assembly facility in the existing industrial area of Port Gardner Bay (Kaiser Steel Company proposal in the Port of Everett). The proposal involves hydraulic dredging of about 3 million cubic yards from the existing channel and marina and filling about 80 acres of tidelands. The facility would be used to fabricate steel towers and appurtenances for transport and use as offshore oil well drilling platforms. The placement of fill material would require a 404 permit.
- . A proposed temporary construction site offshore in Commencement Bay, to be used to construct a semisubmersible

floating concrete platform supporting a working deck. The platform would be used for deep-ocean oil field operations. The proposed construction facilities include work barges, floating cranes, a floating concrete batch plant, and attendant equipment.

The difference between the two proposals is that the Port Gardner facility is shore-connected and involves dredging and filling, while the Commencement Bay construction site would be located in deep water (in the navigation channel). The impacts of each proposal are discussed separately below.

Physical Effects:

Port Gardner: The physical effects of the dredging and filling required would include temporary suspension of sediments and turbidity in the water column. Hydraulics in the immediate vicinity will be changed. Tidelands would be converted to upland area; for this particular proposal less than 1% of the tidelands in the Snohomish River estuary would be converted.

Commencement Bay: Temporary turbidity in the water column would result from any spillage of batch plant wash water or concrete materials. The location may cause navigation problems in the area.

Chemical Effects:

Port Gardner: Reduction in dissolved oxygen levels may occur at both the dredging and disposal sites. Dissolved oxygen levels are already low and of concern in the Everett harbor.

Commencement Bay: Spillage of fuel oils or possible leaching from the concrete might affect water quality locally.

Biological Effects:

Port Gardner: Impacts on benthic organisms will occur at the dredging and disposal sites as described above. Population levels would be reduced. Intertidal wetlands would be destroyed, so nursery or feeding areas for fish and shellfish would be lost. Turbidity and dissolved oxygen reduction may cause migrating fish to become disoriented and stressed.

Commencement Bay: Because of the deep water location of the construction, no benthic organisms would be affected

(except if there were spillage of concrete). An interesting problem peculiar to this proposal is that it is located in a major gill net fishing area of the Puyallup Indians. The location is directly in the gill net drift path.

Impact Potential:

Port Gardner: Medium to High
Commencement Bay: Medium to High

Secondary Activities:

Port Gardner: On-shore development of additional support facilities, induced commercial development, on-shore traffic.

Commencement Bay: Navigation.

Secondary Activities and Impacts

Secondary activities are any activities associated with or induced by the primary proposed activity. Many Corps permit activities have increased boating and navigation as a secondary activity. Disposal of dredged material is a secondary activity to dredging. Log storage is a secondary activity in the sense that if pilings or booms are placed, then log storage can occur. The widest range of possible secondary activities results from fill as a primary activity, because the purpose of fill is to create new land. The new land can be used for any form of development allowed under area zoning, comprehensive planning, and shoreline policy. It is essential in assessing the environmental effects of a proposed permit activity to list the most likely secondary activities which may occur and to evaluate their impacts, at least qualitatively.

Some of the secondary activities noted above have already been discussed (e.g., log storage or disposal of dredged or fill material). Types of impacts of the others mentioned are listed below.

<u>Secondary Activity</u>	<u>Impacts</u>		
	<u>Physical/Chemical</u>	<u>Other</u>	<u>Biological</u>
Navigation and Boating	Water quality degradation, discharge of gas, oil, phenols, sanitary wastes, heavy metals	Noise, navigational difficulty.	Effects of boat wastes on aquatic flora and fauna.
Industrial, Commercial, Residential development	Water quality degradation from outfalls (storm water or industrial wastes).	Traffic, noise, air quality degradation.	Effects of outfalls on aquatic flora and fauna. Loss of habitat, changes in type and number of aquatic organisms.
Port expansion and development	Water quality degradation from oil and grease, floatables, particulates.	Traffic, noise, air quality degradation.	Loss of habitat, changes in type and number of aquatic organisms. Water quality effects on aquatic organisms.

Cumulative Impacts

As defined above, cumulative impacts means loss of or encroachment on wetlands and/or degradation of the environment from the additive effects of similar activities or activities with similar impacts. Loss of or encroachment on wetlands can be calculated from the known acreages of wetlands by type in the study area (Section V.A and B and Component A of the overall Study (Section I, Introduction)). Such a calculation is demonstrated in the method for the assessment of environmental impacts below.

Assessment of additive effects requires (a) the determination of the baseline conditions (e.g., number of boats presently using area) and pending or future proposals (e.g., how many boat moorages are proposed), (b) the baseline environmental conditions (e.g., existing water quality), and (c) the cumulative impacts of all proposed similar activities (e.g., amount of pollutants added to water body and consequent degradation of water quality). Much of the detailed information necessary to make a quantitative

assessment of cumulative impacts of this type is not available. However, a qualitative assessment should be made, to express the types and comparative magnitudes of impacts which may occur.

Summary Matrix

Matrix V-2 summarizes the types of environmental impacts or effects which can result from the various activities described above. The purpose of this matrix is to allow a rapid qualitative assessment of a proposed activity and to alert the reviewer to the types of impacts which may occur. More detailed information and annotated references for each activity may be found in Section V.C, Volume II.

The matrix indicates physical, chemical and biological effects of the various activities. Physical/chemical effects include:

- . Hydraulic changes - decrease or change water circulation, interfere with tides and currents, change or obstruct littoral drift, create protected smooth water areas, create reflection waves, change aquatic interaction.
- . Erosion/sedimentation/substrate - cause or prevent erosion of shorelines, stirring and suspension of sediments, change substrate composition, physically change substrate.
- . Water quality - increase turbidity, change salinity, reduce dissolved oxygen, add toxic chemicals, coliform or other organisms, or other pollutants which degrade water quality.

Biological effects include:

- . Benthic flora and fauna - destruction of benthic organisms, changes in species and/or abundance of populations, destruction of vegetation.
- . Water column flora and fauna - changes in phytoplankton and/or zooplankton production, obstruction or change of fish habitat and migration routes.
- . Wetland flora and fauna - destruction of marsh or intertidal populations, changes in species or abundance, impacts or marshes of freshwater runoff or erosion, abrupt habitat change from upland to water.

Matrix V-2
ACTIVITIES AND THEIR EFFECTS

EFFECTS ACTIVITIES		PHYSICAL AND CHEMICAL EFFECTS			BIOLOGICAL EFFECTS				IMPACT POTENTIAL	REMARKS
		Hydraulic Changes	Erosion/Sedi- mentation/ Substrate	Water Quality *	Flora and Fauna					
					Benthic	Water Column	Wetland	Habitat Loss		
1. Dredging	X	X	X	X	X	X	X	X	Medium	Effects depend on method of dredg- ing, substrate composition, and erosion
2. Disposal of Dredged or Placement of Fill Material, Dikes	X	X	X	X	X	X	X	X	High	Significance of impacts depends in part on composition and quantity of fill or dredged material
3. Piers & Docks, Fillings, and Dolphins	+ Slight and localized effects +			Slight			X		Low	Shading effects of piers and docks. Some habitat provided for invertebrates
4. Bulkheads	X	X	X	X	X	X	X	X	High	Abrupt habitat change and elimi- nation of shallows and wetlands
5. Pilots, Buoys, Booms	X			+ Slight shading effects +					Low	Provides some habitat for sessile organisms and cover for fish
6. Log Storage or Rafting	X	X	X	X	X	X	X	X	High	Recovery time for affected ben- thic areas once rafts are removed is about 2 months
7. Marinas	X		X	X	X	X	X	X	Medium to High	If dredging or filling necessary, then dredging or filling impacts would occur
8. Outfall Structures		X		- Effects dependent on type of discharge -					High	Industrial discharges may be toxic to flora and fauna
9. Breakwaters	X	X		X	X	X	X	X	High	Floating breakwaters have less severe effects than fixed ones
10. In-water Construc- tion of Large Marine Facilities	X	X	X	X	X	X	X	X	High	Effects depend on whether con- struction site is located wholly in deep water or partly on shore

* This includes turbidity, biochemical oxygen demand, dissolved oxygen, air chemical effects.

- . Habitat loss - reduction of amount of available wetland, intertidal, or water habitat, affecting all fauna including mammals and birds.

The matrix also indicates qualitatively the potential for adverse impacts of each activity on lands, wetlands, and waters of the study area. Particular facts about each activity are noted under Remarks.

2. Assessment of Environmental Impacts

The method chosen for the assessment of environmental impacts of proposed Corps permit activities in a given location is a modification of that described by Messman, Reppert, and Stakhiv in Wetland Values: Interim Assessment and Evaluation Methodology, Institute for Water Resources, July 1977. The method allows the evaluator to predict the specific and cumulative impacts of a proposed activity in a particular wetland given the dimensions of the activity and the characteristics of the wetland. It is designed to function as a desk-top analysis to allow the evaluator to assess the relative value of a wetland and the potential encroachment of the activity on the wetland's value and functional characteristics.

This approach to impacts assessments is a "red flag" mechanism to separate proposed permit activities with minimal impact from those which cause more significant adverse impacts. The method should provide key input for the decision on whether to require an EIS on the proposed activity. It should provide the evaluator with a means of assessing the public interest.

The method sets up a framework for the assessment of wetland or habitat values using the criteria for natural functional importance and the ancillary criteria as discussed in Section V.C above. The proposed activity is then evaluated in terms of its effect on the natural functional characteristics and the ancillary characteristics. The severity and significance of the effects of the activity are considered by describing the INCIDENCE, MAGNITUDE, and DURATION/TIME. DURATION/TIME assesses when and for how long an effect is expected to persist. INCIDENCE relates to a determination of what significant effect is occurring and where. MAGNITUDE addresses the question of how much of an effect, measured in absolute units (acres, cfs) or as a relative proportion (percent increase or decrease).

An activity or use shows a series of effects which can be divided into four categories of causative elements:

- . Construction activities
- . Physical presence of a structure
- . Operation activities
- . Cumulative effects and secondary effects

Cumulative effects are defined as both the loss of wetlands and habitat acreage in comparison to the remaining amount acreage of wetlands habitats of various types in the estuary and as the additive effects of activities of the same type or with similar impacts. Secondary activities, which indirectly result from the implementation of the proposed activity, should be identified for each proposed activity and their impacts listed.

In general, construction activities and associated effects have been viewed as short-term, while the physical presence of structures, operation, and cumulative effects are considered long-term. The mode of operation, however, may be seasonal, with short-term effects while the operation is on-going but with no significant long-term consequences.

As part of the permit application evaluation, in addition to impact assessment, Corps reviewers must also consider the need for the proposed activity, whether the activity is dependent on being near or in the aquatic environment, and whether feasible alternative sites are available. (These factors are not addressed here.)

The framework proposed by Messman, et. al., attempted to quantify wetland values and activity effects by applying a numerical value system to each value criterion or effect. The numerical value system is an expression of qualitative judgement, but it is one which can lead to an over-reliance on the number generated and an overlooking of qualitative judgment used in assigning the number. The Messman, et. al. format has been modified in this study to leave the judgments of effects and values expressed in qualitative terms only. This does not mean that quantitative data, if available, cannot be used in the expression of value or effect. On the contrary, quantitative measures (specific wetland acreage, percent of habitat in estuary, specific fauna associated with area, specific pollutants generated) are to be used wherever possible. However, for purposes of this study it was determined that the numerical value rating system was not a meaningful part of the method and only tended to obscure the fact that value judgments are used by the permit application reviewer.

The approach to impact assessment of a proposed activity in a given location is shown in the following example. Notes in brackets are procedures to be followed during the assessment.

EXAMPLE

- a. **Proposed Activity:** A sanitary landfill on the northwest portion of Otter Island. Fill materials will be household wastes compacted into high-density bales barged to the site. Fifty (50) acres is to be filled. [Note: A landfill similar to this but located on Ebey Island just south of Otter Island was proposed in 1975.]
- b. **Exact Location:** The 50 acres is in the northwest corner of Otter Island, north of a small tidal channel, running northwest from the center of the island. [Using the detailed habitat maps (from Volume III) locate the proposed activity boundaries as exactly as possible.]
- c. **Habitat Types:** [Identify from the habitat type maps the habitat types affected by the proposal.]
1. 6111 Spruce Swamp
 2. 6252 Cattail/Bulrush Marsh
- d. **General Value of Area:** It is in an Area of Importance. [Check the Findings (Plate 2) to see if the proposed activity is located in an Area of Importance (AOI) or Area of Environmental Concern (AEC), Section V.B.]
- e. **General Value of Habitats:** Both 6111 and 6252 are identified as Wetland Types. [Check Section V.A to see if the habitat types identified in (c) above are Wetland Types (WT).]
- f. **Characteristics of Area and Habitats:** [If the proposed activity is in an AOI, AEC, or WT, review the characteristics of the area discussed in the area-specific description (Sections V.A and V.B).]
- g. **Acreage Affected by Proposed Activity:**

Area:	Total acreage	147
	Amount proposed	50
	for activity	—
	Amount remaining	97

Total Acreage of Wetlands in Estuary (1977) = 1,862.
Area represents about 8% of total estuary wetlands.

<u>Wetland Types:</u>		<u>Acres</u>
1. 6111	Total in area	82
	Amount proposed for activity	30 (37% of area total)
	Amount remaining	52
	Total in Estuary	300
	Amount proposed for activity	30 (10% of total)
2. 6252 (625)	Total in area	65
	Amount proposed for activity	20 (30% of area total)
	Amount remaining	45
	Total in Estuary	720
	Amount proposed for activity	20 (3% of total)

[Obtain these numbers as follows: Total acreage and wetland acreage in area from AOI description. Total acreage of wetland types in estuary from WI descriptions. For some wetland types, it is best to work at a less detailed level than level 4 in the classification scheme. In this example, for instance, the fourth level of detail in 625 habitat is not an important distinction.]

- h. Characteristics of Activity: [Describe the general characteristics of the proposed activity, using the material given in the application and supplemented by the applicant, if necessary.]

Characteristic of Activity:

- 1) Construction of fill; operation of a sanitary landfill is a construction process.
- 2) Duration: 5 years to complete the fill.
- 3) Incidence: Clearing spruce swamp, covering marsh and swamp, and filling to a final elevation of 18 feet above mean sea level (after settling).
- 4) Magnitude: 30 acres of spruce swamp and 20 acres of cattail/bulrush marsh will be destroyed, at the average rate of 10 acres total per year.

5) Long-term/Short-term: Placing of fill is irreversible. It constitutes a long-term destruction of the marsh habitat.

- i. Specific Impacts of the Proposed Activity: [Assess the effects of the proposed activity on the natural functional characteristics and ancillary characteristics of the area and habitat types in terms of incidence, magnitude, and duration. Use the general impact description in Section V.C, supplemented by specific data at level of analysis desired (where available). Specific data may be obtained from references listed for each activity. Use the specific area descriptions (Sections V.A and V.B) to determine the existing characteristics where possible. If area is one for which there is no specific description, then information on physical and biological characteristics of habitat types may be found in Section VI and data on ancillary characteristics is in Section VII. The analysis should proceed in the order laid out in Section V.A (Criteria). Examples of assessment are shown for the characteristics of natural biological functions and specific local policies (Section V.A).]

1) Example: Natural Biologic Functions

- . The area: 50 acres valuable for feeding, nesting, and breeding of marsh birds, small mammals, and deer will be destroyed. The encroachment of 50 filled acres on this 147-acre isolated unit will reduce the security for wildlife it now provides, both because one-third of the habitat will be destroyed and because the entire isolated island will be invaded. If the fill affects the small tidal channel, or changes the drainage characteristics in its vicinity, the aquatic interaction capacity of the undisturbed portion of the island may be adversely impacted; this may in turn affect detritus export, nutrient cycles, and fish nurseries and feeding. If leachate from the fill degrades water quality in the remaining marsh and swamp and in the slough waters around the island, it may adversely affect marsh and swamp inhabitants and might result in kills of juvenile fish in the tidal channels and sloughs.
- . Wetland 6111, Spruce Swamp: 30 acres (37%) of the largest parcel of this habitat type in the estuary will be destroyed; this 30 acres represents 10% of this habitat in the entire estuary. Its destruction means the loss of a substantial

percentage of a diverse plant community, supporting a wide variety of fauna including birds and large and small mammals. The swamp is highly productive and harbors organisms that represent important links in the food web.

- . Wetland 6252, Cattail/Bulrush Marsh: 20 acres (30%) of this habitat type in this area will be destroyed; however, this is only 3% of the total amount of this habitat type in the estuary. The acreage on Otter Island is one of the larger and more isolated parcels in the estuary. The dense vegetation in this marsh provides protective cover for birds and animals; the protective value will be diminished because of the destruction of 30% of the marsh and the proximity of the fill (and possible future development). A highly productive area will be destroyed. A substantial percentage of a habitat type valuable to birds and small mammals for feeding and nesting and to deer for resting will be lost.

2) Example: Specific Local Policies

- . The entire island has been recommended for preservation in the SRB Mediated Agreement; filling 50 acres would mean disregard of this policy. The filled area would make the remainder of the island less valuable and less attractive for preservation/acquisition. Filling this area would be inconsistent with the intent of Snohomish County's Conservancy shoreline designation, which applies to the entire island.

j. Summary of Specific Impact Potential: [Summarize and judge level of specific impacts on natural functional characteristics and ancillary characteristics. Describe impact potential as low, medium, high, and list most important reasons.]

The impact potential of the proposed 50-acre fill on Otter Island is high, because of the following:

- 1) The complete destruction of 50 acres of highly productive marsh and swamp wildlife habitat, representing one-third of an AOI and 10% of the spruce swamp habitat in the estuary.
- 2) The loss of habitat with dense vegetation and diverse plant and animal populations.

- 3) The loss or reduction of aquatic interaction, changing nutrient cycles and detritus export in the estuary.
- 4) (other natural functional characteristics affected)
- 5) Inconsistency with expressed preservation policies of Snohomish County and the SRB Mediated Agreement.
- 6) (other ancillary characteristics affected)

k. Cumulative Impacts; Loss of Wetlands: [Compare the acreage proposed for the activity with the historic trend for the activity in the estuary over time, obtained from Tables VII-1 to VII-5 in Section VII. Review other active permit applications to determine acreage proposed for the same activity (or resulting in the same loss) and the areas and habitat types affected. Find the total amount of existing acreage of these habitats (Sections V and VI) and the acreage lost if all pending permits were issued. These figures should indicate the cumulative effects of the proposed activity and other activities resulting in loss of wetlands.]

- 1) Acreage proposed for this fill 50 acres
- 2) Historic trend in filling; acres 13.7 acres/yr
converted to fill per year since 1970 (Note: the fill rate in the estuary is increasing exponentially) 68.5 acres/5 yrs
- 3) Other active permit applications which would result in loss of wetlands by fill

Name	Total wetland area	89 acres
	Habitat 6252	80 acres
- 4) Total loss of wetlands if all permits issued 144 acres
- 5) Total wetlands in study area 1977 1,862 acres
- 6) Percent of total wetlands lost 8%
- 7) Total loss of Habitat 6252 if all permits granted 100 acres

8) Total Habitat 6252 in study area 720 acres
1977

9) Percent of total 6252 lost 14%

1. Summary Statement of Loss of Wetlands: If all permits for which applications have been made are granted, 8% of study area wetlands will be lost. The proposed activity represents 30% of the 8%, or 2.4% of total wetlands lost. Fourteen percent (14%) of habitat type 6252, a highly productive cattail/bulrush marsh valuable as wildlife habitat, would be lost; the proposed activity represents 20% or 2.8% of total cattail/bulrush marsh lost.

- m. Cumulative Impacts; Additive Effects: [Determine baseline conditions of environmental factors likely to be affected by the proposed activity (Sections VI and VII). Review other activities and active permit applications to determine where other similar activities or activities with similar impacts are occurring. Qualitatively assess the likelihood of significant additive impacts. An example is shown for water quality impacts.]

Environmental Factor: Water quality

Baseline Condition: Generally within standards in this portion of the estuary

Active Permit Applications:

	<u>Name</u>	<u>Location</u>	<u>Activity</u>	<u>Impacts</u>
1)	--	South of Otter Island, on north tip of Ebey Island	Woodwaste, fill	Possible leachate toxic to aquatic organisms
2)	--	South of Otter Island on Ebey Slough	Expansion of Lake Stevens sewer lagoon	Increased discharge of lagoon effluent

- n. Summary Statement of Additive Effects: Two permit applications for activities having possible adverse effects on water quality are pending; the locations are just upstream from the proposed sanitary landfill location. There is a potential for significant water quality degradation from the additive effects of these three proposals.

- o. Secondary Activities and Impacts: [Determine allowed uses in the area from the description of development pressure in the area-specific descriptions (Section V.B), general development pressure (Section V.D) and agency plans and policies (Section VII). List possible or likely secondary activities and general impacts.]

Secondary Activities: Use of the fill for development.

Development Pressure: Negligible, due to specific area preservation policies, lack of access or public services.

Allowed Uses (under present zoning): Agriculture (unlikely on fill); Residential Development at one unit/10 acres.

Possible Other Uses: Park development.

Secondary Impacts: Residential Development. If there is pressure to rezone for higher density and to establish some road access, then likely impacts include increased storm water runoff and water quality degradation, construction impacts of roads, traffic, noise, further wildlife habitat loss, and so on.

Park Development. If no road access is developed, then boating would increase. Further encroachment on and disturbance of wildlife habitat would occur.

- p. Is an EIS on the Proposal indicated?

_____ No

The decision as to whether an EIS would be necessary on this proposed activity is not made here. It is a question of judgment, which would be made by Seattle District in considering not only the information and guidance contained in this study, but also the significance of the impacts in relation to project benefits, degree of water-dependency and alternative sites, and

the public interest. This study outlines the framework and basic information that provides key input with which to make that judgment. Supplemental information may be developed in much more detail from references on activity characteristics. (For example, one could compute increased runoff volumes due to the fill and examine drainage characteristics in more detail.)

D. DEVELOPMENT PRESSURE IN THE SNOHOMISH ESTUARY STUDY AREA

1. Of the many factors influencing land development, the following are discussed here:

- . Existing and historic land use
- . Accessibility and availability and urban-level services
- . Plans and policies
- . Ownership patterns and zoning.

Each of the above factors is discussed for the estuary study area as a whole. The history of permit applications and the historical changes in land use over time are described and used to project a general level of activity for the future. A summary describes general areas in which pressure for development is expected to be high, medium, or low. Reference is made to specific plates and sections of Volume II where detailed information can be found. Finally, wetland enhancement is discussed with reference to specific sites in the estuary.

Existing and Historic Land Use (Land and Water Use, Section VII)

2. In the 100 years since development began in the Snohomish estuary, many changes have occurred. The floodplain of the Snohomish River and its sloughs has mostly been diked and converted to agricultural use. The 10,950 acres of wetland which existed in the estuary in 1885 have been diminished by diking and filling to about 1,900 acres in 1977. Industrial and urban uses have taken over the Everett shoreline and the waterfront in the Port of Everett almost completely, leaving isolated areas of open space and mudflats. Land use in 1977 is shown in Plate 12 (Section VII, Land and Water Use).

3. Figure VII-1, derived from aerial photo interpretation and analysis of historical topographic maps (Land and Water Use, Section VII), shows the historic trends in land use in the study area in terms of wetlands, diked areas, agriculture, and industrial land use. As dikes were built, wetlands behind the dikes were drained and used for agriculture. In some diked areas large amounts of acreage remain in wetland, but they are non-tidal wetlands, isolated from tidal influence by the dikes. The lowest amount of wetlands acreage was in the 1940's; this remained about the same until some time after 1955, when dikes were breached on North Ebey Island, Spencer Island North, and the east and west shores of the estuary. When the dikes breached, the acreage within reverted to tidal wetlands.

4. Since the early years of development in the area, industrial or heavily urbanized uses have encroached on the river floodplain only to a limited extent. Old Highway 99 (SR 529) and the railroads cross the floodplain between Everett and Marysville; I-5 was built close to this existing floodplain transportation corridor at the

north end of the estuary. This transportation corridor is viewed as a possible line of demarcation for groups interested in both development and preservation of the estuary. East of this corridor there is very little urban-type development. There are a few scattered residences, but no areas of concentrated housing in the floodplain. Between the Snohomish River and Ebey Slough east of I-5 the largest amount of land given to urban development is that on which the Everett sewer lagoons are located. Virtually the entire remainder of the estuary floodplain east of I-5 is either in agriculture or open space/wetland (mostly agriculture). West of and immediately around the transportation corridor the land use situation in the floodplain is quite different. A substantial amount of this acreage has been filled (Plate 12). Former wetlands on Smith Island are now used for forest products industry, including large settling and treatment ponds for the wastes from the pulp mills. The transportation corridor serves as a symbolic dividing line in the estuary between industrial and rural land uses.

Accessibility and Availability of Urban Services (Institutional Profile and Land and Water Use, Section VII)

5. Much of the estuary floodplain is accessible only by boat or by private roads. There are very few public roads into the floodplain itself between the Snohomish River and Ebey Slough; these are on parts of South Ebey Island and in the Highway 2 area and in the areas of Smith, Spencer, and North Ebey Islands around the SR 529-I-5 corridor. There are no sewer districts with service in the floodplain (Plate 18, Section VII) and the only sewer lines are those to the sewer lagoons and the lagoon discharges. Residential development in the estuary floodplain east of I-5 between the Snohomish River and Ebey Slough is not sewered. Water service in the floodplain is from private wells serving one or several families (Institutional Profile, Section VII). Overall, although the estuary floodplain is adjacent to a major port and urban area, most of the area does not have urban-level services.

Plans and Policies (Institutional Profile, Section VII)

6. Many of the local (city and county) plans have policy statements referring to specific parts of the estuary study area in which development should be encouraged or which should be preserved free from development (Section VII, Institutional Profile, Local Government). Snohomish County's Comprehensive Plan and the specific area plans which are parts of the overall comprehensive plan emphasize the retention of agricultural land in agricultural use. These plans show areas of greenbelt, open space, and agriculture. Ever-

ett's Community Plan has specific policies for retention of agriculture, development of recreational areas and open space, and the location of new industrial growth along the west bank of the Snohomish River near Lowell. The shoreline designations of Snohomish County, Everett, and Marysville under their Shoreline Master Programs show almost the entire west bank of the Snohomish River, all of the Port Gardner area, all of Smith and Spencer Islands west of I-5, and North Ebey Island west and east of the highway corridor as an Urban environment, suitable for urban-type development (Plate 16, Section VII). The remainder of the estuary floodplain is designated Rural or Conservancy, except the large Game parcel on Ebey Island which is designated Natural. Jetty Island has a special shoreline designation requiring the development of a comprehensive plan for the island before any urbanization can be done. The shoreline from Priest Point to north of Tulalip Bay is almost all designated Suburban, while these tidelands are Conservancy.

7. The Port of Everett's Consensus Guidelines indicate the Port's intent to preserve the entire floodplain from mid-channel of the Snohomish River to mid-channel of Ebey Slough free from any further designation of dredge material disposal sites (Plate 17, Section VII). The Snohomish River Basin Mediated Agreement (Institutional Profile, Local Governments, Section VII) makes recommendation for preservation of the delta lobes and biologically functioning surge plains of the Snohomish River; the areas indicated are shown in Plate 17 (Section VII). Federal, state, and regional agencies with interest and/or jurisdiction in the floodplain have general policies calling for the preservation of biologically important, productive, valuable wetlands, agricultural and floodplain lands, archeologic and historic sites, and educational, scientific and recreational areas (Plate 20, Section VII).

Ownership and Zoning (Ownership and Institutional Profile, Section VII)

8. Land ownership patterns in the estuary floodplain are shown in Plate 13, Section VII. A substantial portion of the floodplain is in large ownerships (400 to 1,100 acres per owner). The area around the Everett and Marysville sewer lagoons is public-owned, as are the Department of Game lands. Several areas on South Ebey Island have been platted; these are in the vicinity of the main north-south road on this island. The remainder of the floodplain is in various small ownerships.

9. The Snohomish County Agriculture zone (A-10), allowing one house/10 acres, covers the floodplain south of Highway 2. The Rural zone (RU) covers Ebey Island, Spencer Island South, and Smith Island north of Highway 2 and east of I-5. Otter Island and North

Ebey Island are also RU. Spencer Island North is zoned for heavy industry (HI). West of I-5, Smith Island is a mixture of Rural and Light Industry (LI) zones (Institutional Profile, Local Government, Section VII).

10. About half of the Port Gardner area is owned by the Port of Everett or the state; the remainder is in private ownerships, usually businesses (Plate 13, Section VII). There is some controversy about the ownership of Jetty Island. The Port of Everett claims ownership of the Jetty, defined as about 230 acres of uplands and 1,650 acres of wetlands and tide flats in the Port's Consensus Guidelines (31 October 1977). However, the State Department of Natural Resources (DNR) also claims ownership of Jetty Island and its tidelands, in particular of the sand of which the island is made. As far as can be ascertained, Jetty Island and its tidal flats may be partly the result of deposition of dredge materials along the west side of the Jetty and partly the result of the diversion of flow from the main channel of the Snohomish to the south through Port Gardner. The resolution of the ownership question is unclear. Almost all of the tidelands east of I-5 are state-owned, although some are leased out. Areas of private tideland ownership east of I-5 are along the west banks of the Snohomish River and Steamboat Slough. West of I-5 all the tidelands/mudflats along and west of Smith Island are in private ownership (Plate 13, Section VII).

11. The shoreline and tidelands along the coast from Priest Point to north of Tulalip Bay are on the Tulalip Reservation. Their development is managed by the Tulalip Tribes. Much of this area is already in residential development and small private ownerships. The ownership of the tidelands between Quilceda Creek and Marysville was disputed between DNR and the Tulalip Tribes until 1976, when the conflict was decided in favor of the Tulalip Tribes. The DNR believes that the tidelands and bedlands west of North Ebey Island are also under Tulalip ownership.

History of Permit Applications and Industrial Land Use (Section IV and Land and Water Use, Section VII)

12. In the Snohomish estuary study area about 15 to 30 permit applications per year have been made since 1972 (Section IV). About 80% of the 1971 and 1972 applications were issued, while about 60% of the 1973-1975 applications were issued. Sixty percent (60%) of applications in 1976 have been issued, but about 30% have not yet had action taken. Numbers for 1977 are incomplete. The majority of the issued and no-action permit applications are located in the Snohomish River and its sloughs. Proposed activities have mostly been dredging, fill and dredge material disposal, pilings, bulkheads,

and piers (Section IV). These are activities supporting shipping and industry, log storage, marinas, and other types of land and water use in the estuary (Section IV). Using the historical data, one would expect between 15 and 30 permit applications per year, involving mainly dredging, fill, pilings, and bulkheads. Fifty to sixty percent of these would be located in the Snohomish River and sloughs.

13. As shown in Figure VII-1 and Table VII-8 (Land and Water Use, Section VII), the amount of land used for industry in the estuary study area (including the Port of Everett) has increased about 120 acres per decade since 1947. Projecting this rate of industrial land increase, there would be about 800 acres in industrial use by 1990 and about 920 acres by the year 2000.

Development Pressure in the Study Area

14. Portions of the study area in which development pressure is judged to be high include the following.

1. The Port Gardner waterfront and channel, from the water tank at the south end to Preston Point at the north. Pressure on parts of the Maulsby mudflats is heavy and immediate.
2. The west bank of the Snohomish River from Preston Point to the curve south of the Lowell area.
3. Smith Island west of SR 529 to the beginning of the entrance mudflats.
4. Spencer Island west of I-5.
5. North Ebey Island from the narrow neck opposite the Marysville sewer lagoon west to the westward boundary of the Tulalip fill.

15. Areas in which development pressure is judged to be medium to high include:

1. The south tip of Jetty Island, where a specific dredge material disposal site is proposed.
2. The Weyco Islands, which have been partly filled already. Their inaccessibility may tend to reduce this pressure.

16. Areas in which development pressure is judged to be medium include:

1. North Ebey Island from the west boundary of the Tulalip fill west to and including the north part of entrance mudflats and Quilceda Island.
 2. The south part of the entrance mudflats from the west end of Smith Island west to the breakwater and the west end of Priest Point. All of this area is in private ownership.
 3. On Smith Island, the area east of SR 520 and west of I-5, but including the proposed dredge material disposal site just east of I-5 near the Everett sewer lagoons.
 4. Spencer Island North from the northern end of the mid-Spencer wetland north and west to the I-5 corridor. Although this area is east of I-5 and is actively used for agriculture, its present zoning is for heavy industry (HI).
 5. The portion of Tulalip Bay in which the proposed marina complex is located; this is the southeastern part of the bay.
17. The remainder of the floodplain study area and the coast are judged to be under low to negligible development pressure. This area includes the following:
1. The coast from Priest Point north to and including Tulalip Spit and its associated mudflats (except the proposed marina site).
 2. All of Jetty Island and the Jetty Island mudflats.
 3. Maulsby Swamp.
 4. The Quilceda Creek area.
 5. The estuary floodplain including Smith Island to I-5 (except the sewer lagoon area), South and Mid-Spencer Islands, all of Ebey Island, Otter Island, North Ebey Island south and east of the narrow neck opposite the Marysville sewer lagoon, and the east shore from the confluence of the Snohomish River and Ebey Slough north to the Marysville sewer lagoon. It should be noted that a considerable portion of Ebey Island south of Highway 2 has been platted and is accessible by road, and thus it might feel more pressure to develop. However, its zoning (A-10) is quite restrictive.

18. In conclusion, it may be useful to relate the amount of land converting to industrial use each year to some of the areas under heavy development pressure. From the historical trend, about 120 acres of land every 10 years converts to industrial use. The Maulsby mudflats and the Tulalip fill are each larger than 120 acres. North Ebey Island from the narrow neck west to the east edge of the Tulalip fill has about 100 acres of wetland area at present.

Enhancement Possibilities

19. Wetland enhancement is the process of improving or creating wetland habitat types. Enhancement possibilities considered in the study include elimination of log rafts on tidal flats and creation of wetlands through dike removal.

20. Extensive mudflats at the west end of Smith and North Ebey Islands, and in the vicinity of Maulsby Swamp, have historically been used for log rafting. Smith (1977) assessed the biological importance of these areas, the environmental impacts of log rafting, and the return of the habitat to a natural state with the removal of the log rafts. The study showed that log rafting areas recover from the impacts very quickly, and may revert to natural productivity within a few months (depending on season). Approximately 350 acres of mudflats in the study area are routinely used for log storage. Permanent removal of log rafts from these flats would probably result in their reverting quickly to their natural productivity. This would improve the habitat value of these flats to both fish and waterfowl.

21. Removal or breaching of dikes protecting areas within the floodplain would result in reversion of these areas to wetlands. This occurred on North Ebey Island in the 1940's due to flood damage to dikes. The result was the conversion of approximately 300 acres of agricultural land to wetlands. This same process might be carried out on any of the other islands. However, unless the entire island were to be converted to wetlands, new dikes would have to be built around the area of interest in order to protect the remaining part of the island. Any floodplain areas which were returned to hydrologic connection with the estuary would probably revert quickly to wetlands.

Section VI

ENVIRONMENTAL PROFILES

Section VI

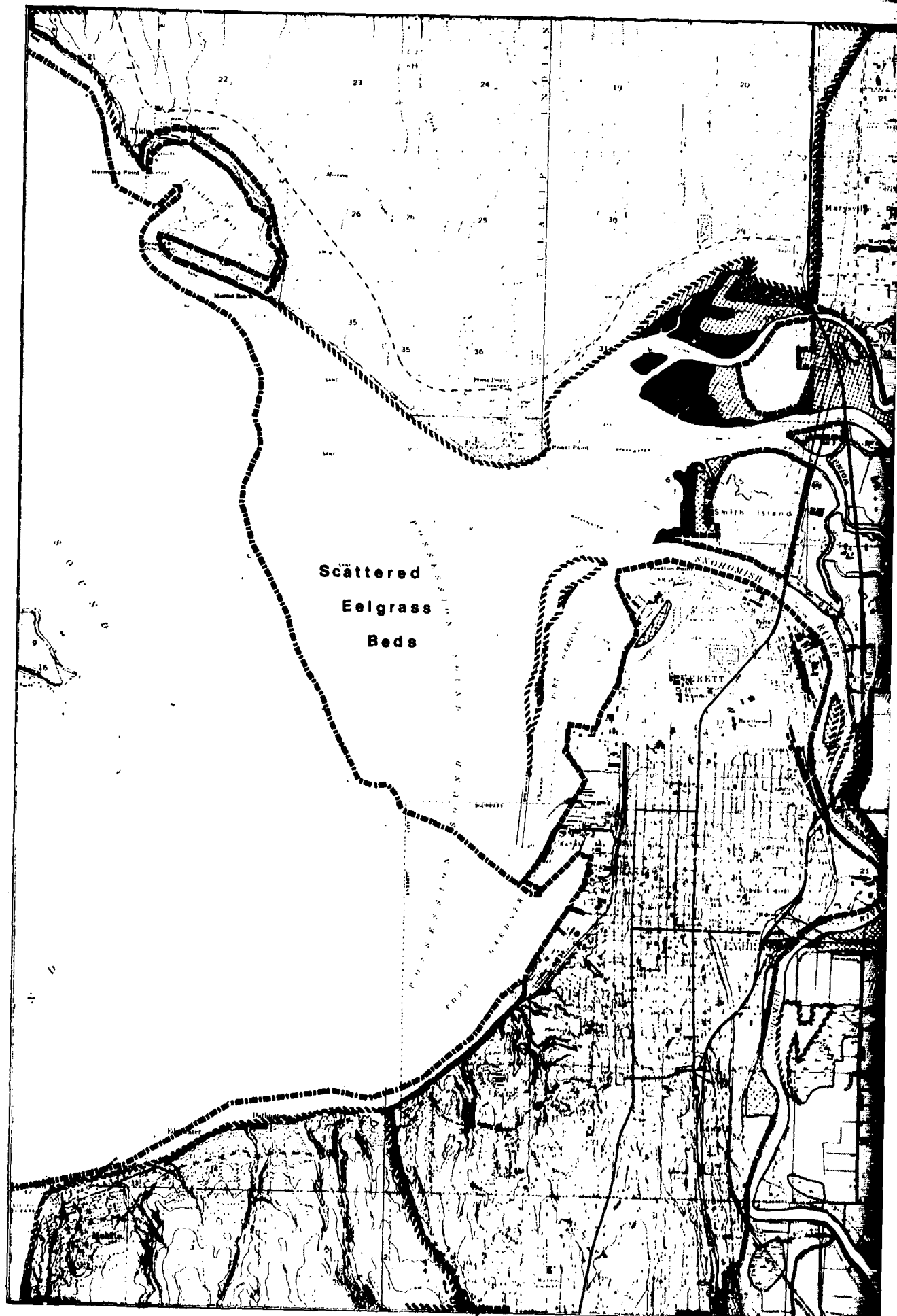
ENVIRONMENTAL PROFILES

A. PHYSICAL AND BIOLOGICAL PROFILES

1. Detailed descriptions of the physical and biological characteristics of habitat types found in the Snohomish estuary study area are given in Section VI of the Technical Document. The habitat types were classified and mapped as Component A (Burrell, 1978) of the Snohomish Estuary Wetlands Study. A summary of the results of that component is presented in Plate 9. Matrix VI-1 is a summary of the acreage of habitat types within the study area.

2. The physical factors discussed include geography, climatology, soils, geology, geologic hazards, hydraulics, and water quality. The biological profiles include discussions of flora, fauna, productivity food webs and nutrient cycling. The information presented in the technical document was used to assess the relative value and importance of various areas within the estuary (see Section V.B).

3. Matrix VI-1 summarizes the important information presented in the Physical and Biological Profiles. "Flora" designates the dominant vegetation found in each habitat type. "Fauna" identifies the principal animal species which use a habitat for breeding and feeding. "Wetland" designates whether a habitat type is so defined under 33 CFR 323.2(c) and "Corps jurisdiction" identifies which habitat types require individual Corps permits under Section 404 of the Federal Water Pollution Control Act of 1972 or Section 10 of the Rivers and Harbors Act of 1899.












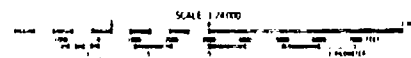


HABITATS

PLATE NO 9

LEGEND

-  Urban Boundaries
-  Vegetated Uplands
-  Agricultural
-  Salt Marsh
-  Brackish/ Freshwater Marsh
-  Brackish/ Freshwater Swamp
-  Freshwater Swamp
-  Freshwater Marsh
-  Approx Boundary Scattered Eelgrass Beds



SNOHOMISH ESTUARY WETLANDS STUDY

Source: Burrell 1977
Boule and Shea 1978

Matrix VI-1

PHYSICAL AND BIOLOGICAL CHARACTERISTICS OF HABITAT TYPES

Habitat Types	Area ¹ in Acres	Flora ²	Fauna ³				Primary Productivity	Aquatic Interaction	Wetland ⁴	Corps juris- diction ⁵
			Mammals	Birds	Fish	Invertebrates				
Urban	1389		domestic animals, mice, rats	crows, pigeons, sparrows, star- lings		insects	low	very low	No	No
Agriculture	5105	cultivated crops	domestic animals, mice, rats, rabbits	crows, sparrows		insects	low-medium	very low	No	No
Non-forested Grassland	527 (6)	fescue, dune grass, bent grass, canary grass, velvet grass	rodents, rabbits	sparrows, quail, nighthawks, terns		insects	medium-high	low	No	No
Shrubland	(521)	blackberry, spiraea, scotch broom, nine- bark, vine maple, dogwood	rodents, rabbits, skunk, deer, weasel, mink	wrens, tits, chickadees		insects	medium-high	low	No	No
Forested	983	Douglas fir, hem- lock, cedar, alder, maple	rodents, deer, mink, weasel, coyote, raccoon, opossum	sparrows, wrens, chickadees, jays, grouse, woodpeck- ers, hawks, owls		insects	medium-high	low	No	Some Areas
Water	1504	phytoplankton	beaver, otter, muskrat	ducks, grebes, mergansers, king- fishers, gulls	salmon, cutthroat steelhead, bottom fish, sculpin	clams, crabs, zooplankton	medium	very high	No	Yes
Intertidal Swamps	528	willow, swamp dog- wood, spiraea, nine- bark, wildrose, Sitka spruce	rodents, mink, weasel, muskrat, raccoon, beaver, otter	wrens, sparrows, chickadees, wood- peckers, herons, hawks		insects	medium-high	medium to high	Yes	Yes
Freshwater Swamps	644	same as above, with lodgepole pine	same as above	same as above		insects	medium-high	low-medium	Yes	Often
Algae	203	sea lettuce, rock- weed, Enteromorpha		ducks, geese		sediment dwellers	very high	very high	Yes	Yes
Eelgrass	853	eelgrass		ducks, geese	juvenile salmon, trout and bottom fish, sculpin	crabs, clams, zoo- plankton, snails, sediment dwellers	medium ⁶	very high	Yes	Yes
Salt Marsh	403	pickleweed, sedge, arrowgrass, salt grass, bent grass, silverchord, aster	occasional deer, raccoon	ducks, rails, swallows, herons	juvenile salmon, trout, marine fish	insects	medium-high	high	Yes	Yes
Brackish/Fresh- water Marsh	719	bulrush, cattail, sedge	rodents, deer, muskrat, beaver, raccoon	redwing black- birds, herons, bitterns, rails, wrens	juvenile salmon, trout	insects	medium-high	medium-high	Yes	Yes
Fresh Marsh	83	bulrush, cattail, rush, canary grass, bur-reed	same as above	same as above	juvenile trout and salmon	insects	medium-high	low	Yes	Often
Aquatic "Unvegeta- ted" (Mudflats)	1660	phytoplankton, benthic diatoms		sandpipers, dun- lins, herons		clams, sediment dwellers			No	Yes

Matrix VI-I (Continued)

FOOTNOTES

¹ Acreage within land use study area except algae, eelgrass and unvegetated. The latter are located in Possession Sound and acreage is estimated.

² Principal species; not every species found in every example of habitat.

³ Indicates principal habitat; does not include occasional visitors.

⁴ As defined in 33 CFR 323.2(c).

⁵ Under Section 404 of FWPCA (1972) and/or Section 10 of Rivers and Harbors Act of 1899.

⁶ Eelgrass productivity estimates vary considerably.

B. PUBLIC AND LAND USE PROFILES

1. At the end of the last century the Snohomish estuary was an undeveloped area. Extensive wetlands in the river floodplain were surrounded by forested slopes. There was very little diked area and very little agriculture in the estuary delta. The floodplain was in a pristine state.

2. Today the study area is drastically different. Port Gardner and the Everett shoreline are heavily developed. The floodplain of the estuary is mostly diked and used for agriculture, with urban activities occurring on filled areas and on the slopes above the floodplain. Highways bisect the river floodplain. Sewer lagoons to serve the growing cities are now located in the delta and discharge effluent into the Snohomish River. There is continued pressure for new industrial, commercial, and residential development in and around the floodplain. Concern about wetlands and floodplain already lost to urbanization has grown, and a desire to preserve remaining wetlands free from urban encroachment is developing among agencies and the public alike.

3. It is the purpose of this profile to provide a picture of land use and public policy in the Snohomish estuary. Such a picture is essential to an understanding of the pressure to further develop the delta and of the potential changes in the estuarine and delta ecosystems.

Land and Water Use

4. Existing land use in 1977 in the study area is shown in Plate 12. The land use categories delineated are described in Table VI-1. Agriculture is a major land use east and south of I-5. The major wetlands are in the north and west portions of the estuary, with some smaller wetlands to the south. The industrial land uses occur in the I-5, SR 529 corridor and in the waterfront area in Port Gardner.










5. Trends in land and water use were determined by aerial photo interpretation for the years 1884-1885, 1895-1911, 1941, 1947, 1955, 1969-70, and 1977. Table VI-2 summarizes some of the trends in land use and Figure VI-1 shows the trends graphically. In 1884-85 virtually the entire estuary was wetlands; by 1895-1911 approximately 30% of the wetlands had been diked for agricultural purposes. By 1941 or the beginning of World War II, about 80% of the estuary had been diked; more than half of the estuary land area was being used for agriculture. Industrial land use was minimal and remained so until the 1950's when the wood products industry began expanding. The amount of land in agriculture has not fluctuated significantly since 1941. Industrial land use has almost doubled, but is still a small percentage of the total land in the estuary.

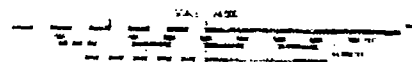


LAND USE 1977

PLATE NO 12

LEGEND

	Agriculture
	Dike
	Fill
	Industry
	Log Storage
	Marina
	Open Space
	Sewage Treatment
	Wetlands



SNOHOMISH ESTUARY WETLANDS STUDY

PLATE NO 12

Table VI-1

LAND USE CATEGORIES

Open Space (OS): Any woodland, or any grassland which was not agriculture. May include occasional houses in sparsely populated areas.

Wetland (W): Any marsh, swamp, or vegetated intertidal area.

Open Space, probable Wetland (OS(W)): Open areas, especially woodlands which were suspected of being wetlands (swamp). This was limited to historic photos where area in question was a swamp at present but could not be distinguished from open space in photograph

Dike (D): An embankment constructed to prevent flooding of low areas. In some areas dikes have been enlarged considerably through the emplacement of wood waste fill.

Freeway (FW): Major local, state and federal highways; includes major county roads on Ebey and Smith Islands.

Agriculture (A): Any areas used for pasture or row crops. May include occasional houses in sparsely populated areas.

Industry (I): Any commercial or manufacturing business, includes port facilities, lumber mills, boat building, and parking areas associated directly with a specific business.

Public Services (PS): Sewage treatment ponds, pipeline corridors, power line corridors, military installations.

Residential (RS): Single family or multiple family dwellings, density greater than 1 unit per acre.

Recreation (RC): Parks and boat launch ramps. Does not include marinas.

Marina (M): Areas for mooring or storing boats.

Fill (F): Deposition of material, includes dredge material disposal; often difficult to identify because an industry or other use might be placed upon it.

Log Storage (LS): Log rafting and upland storage area. In-water rafting was included with water when calculating total areas.

Waterways (WW): All natural water bodies in the area such as sloughs, creeks and ponds. Mudflats and log rafting areas were included also.

Railroad (RR): Railroad tracks, switching yards and maintenance facilities.

Table VI-2

LAND USE SUMMARY TABLE

	<u>Wetland</u>	<u>OS(W)</u>	<u>Diked</u>	<u>Agri- Culture</u>	<u>Industrial</u>
1977	1,862	0	8,025	5,381	650
1969-70	1,974	29	7,916	5,575	569
1955	1,445	175	8,328	5,895	370
1947	1,399	15	8,389	5,513	289
1941	1,504	145	8,524	5,344	344
1895-1911	7,713	0	3,239	--	--
1984-85	10,846	0	74	106	--

-- No data available

Table VI-3

WETLAND SUMMARY TABLE

	<u>1977</u>	<u>1969-70</u>	<u>1955</u>	<u>1947</u>	<u>1941</u>	<u>1884- 1885</u>
Smith Island	147	160	134	152	165	1,917
Ebey Island	171	186	127	167	177	4,029
Spencer Is. North	88	80	4	4	0	459
Spencer Is. South	30	71	65	27	12	440
Otter Island	153	153	153	153	153	153
North Ebey Island	660	749	593	536	453	867
North Shore	392	397	342	342	469	1,040
East Shore	91	47	1	1	1	1,277
West Shore	115	116	9	0	56	634
Weyco Island	<u>15</u>	<u>15</u>	<u>17</u>	<u>15</u>	<u>18</u>	<u>30</u>
	1,862	1,974	1,445	1,399	1,504	10,846

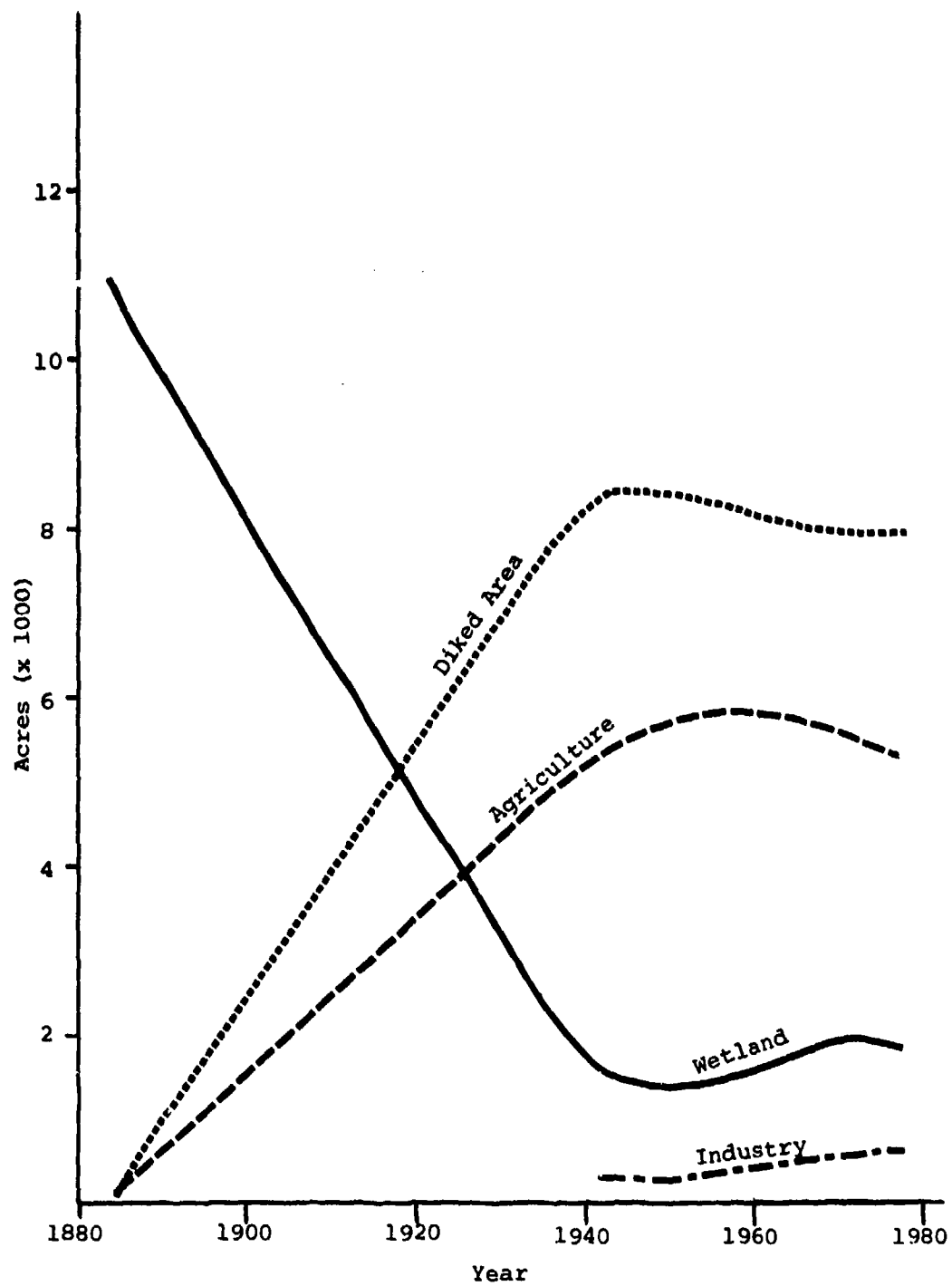


Figure VI-1

LAND USE IN THE SNOHOMISH ESTUARY
1884-1977

6. Of an original 10,850 acres of wetland in the estuary, only 1,500 remained in 1941. This number dropped slightly over the next decade. Between 1955 and 1969-70, the dikes on North Ebey Island, the east and west shore, and Spencer Island North were breached; this added about 500 acres to the wetlands acreage. By 1977 the total wetlands acreage had decreased by about 100 acres. The detailed changes in wetlands by area are shown in Table VI-3.

Public Policy

7. There are various federal, state, regional, and local agencies that interact with the Corps of Engineers during the permit review process. Some of these governmental entities are specific to the Snohomish estuary study area; others, including federal and state agencies, have review responsibility for Corps permit applications throughout the Seattle District.

8. Corps permit regulations (33 CFR 320-329) require an evaluation as to whether the proposed permit activity is in the public interest. For any permit application the Corps considers all applicable official state, regional, or local land use plans and/or policies as reflecting local factors of the public interest (33 CFR 320.4(j)(2)); thus, the Corps will request review of permit applications in the study area by local governments. In addition, the Corps coordinates and consults with certain federal and state agencies (33 CFR 320.4) so that permit decisions will reflect factors of the national and statewide public interest. In the Snohomish estuary study area, plans, policies, and proposed activities are of mutual interest to the Corps and the following principal federal agencies.

1. U.S. Department of the Interior (DOI)

Fish and Wildlife Service
Bureau of Indian Affairs
National Park Service

2. U.S. Department of Commerce (DOC)

National Oceanic and Atmospheric Administration/
National Marine Fisheries Service

3. U.S. Environmental Protection Agency (EPA)

4. U.S. Council on Environmental Quality

5. U.S. Department of Transportation (DOT)
U.S. Coast Guard
6. U.S. Department of Defense (DOD)
U.S. Navy
7. U.S. Department of Agriculture (USDA)
Soil Conservation Service
Agricultural Stabilization and Conservation Service
8. Heritage, Conservation, and Recreation Service
9. Advisory Council on Historic Preservation
10. Federal Power Commission

In addition, the following principal state and local agencies are interested in Corps plans, policies, and permit activities:

1. Washington State Agencies:

- Department of Ecology
- Department of Game
- Department of Fisheries
- Department of Natural Resources
- Department of Highways
- Department of Social and Health Services
- Parks and Recreation Commission
- Office of Archeology and Historic Preservation
- Energy Facility Site Evaluation Council

2. Puget Sound Council of Governments

3. Local Government:

- Snohomish County (including County-wide special districts)
- City of Everett
- City of Marysville

4. Local Special Districts:

- Port of Everett
- Diking Districts
- Drainage Districts
- Sewer and Water Districts

Flood Control Districts
School Districts
Fire Districts

5. Tulalip Tribes of Washington

9. For this study, the most important plans and policies of these agencies are as follows:

- . General preservation policies, referring to the preservation or conservation of wetlands or habitats in general.
- . Specific area policies, referring specifically to the preservation of particular parts of the study area. (What is meant here is a specific statement such as the need to preserve Otter Island or Jetty Island.)
- . Specific criteria or performance standards for the various types of activities requiring Corps permits.

Table VI-4 summarizes the policies of the various agencies. Of the federal agencies, those with most acute interest in proposed activities and who most frequently comment on Corps permit applications are the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and the Environmental Protection Agency. These three are included in Table VI-4. None of these federal agencies have expressed policies for preservation of specific places in the Snohomish estuary study area. Other agencies with expressed general preservation, specific area, or activity policies are also included in Table VI-4. A discussion of all agencies is contained in Section VII.C, Volume II. Under specific area preservation, the numbers refer to the Areas of Importance or Areas of Environmental Concern (Section V.B).

Table VI-4
AGENCY POLICIES

AGENCY	GENERAL PRESERVATION	SPECIFIC AREA PRESERVATION	ACTIVITY STANDARDS
<u>FEDERAL</u> Fish & Wildlife Service	Fish and wildlife habitat, biologically productive wetlands and shallows, estuarine habitats		Water-dependency, all Corps permit activities
National Marine Fisheries Service	Marine, estuarine, and dromous habitats, unique habitat, high productivity, recreational value, unique geology or topography, physical hazard potential, areas protecting coastal resources (aquifer recharge, etc.), critical habitats for endangered species		
Environmental Protection Agency	Maintenance of the chemical, physical, and biological integrity of the entire marine, estuarine, and freshwater systems (40CFR230.5(a)(1)).		Water quality standards, EPA Section 404 (b)(1) guidelines.
<u>STATE</u> Department of Ecology	Preservation of water quality. Shorelines of Statewide Significance (SOSS). Areas		Discharges into navigable waters, certifications under Coastal Zone Management pro-

Table VI-4 (Continued)

AGENCY	GENERAL PRESERVATION	SPECIFIC AREA PRESEKVATION	ACTIVITY STANDARDS
	of particular concern under Coastal Zone Management Act (CZMA)		gram.
Department of Game	Game (wildlife and game fish) resources and habitat. Tideland marshes.	Game owns about 450 acres in the study area	Dredging or other silt-producing activi- ties, dams, diversion ditches and canals, water intake pipes. Hydraulic project per- mit approval.
Department of Fisheries	Foodfish and shellfish habitat and resources		Dredging or other silt-producing activi- ties, bulkheads, land- fills, marinas. Hy- draulic project per- mit approval.
Department of Natural Resources	Management of marine lands for public use, aquaculture, commer- cial use, reserves, anchorage, limited and unobstructed multiple use		Policy for protecting marine environment with specific activity guidelines. Piers & docks, floats & buoys, marinas, log rafts, dredging and dredge material disposal, outfalls, removal of aquatic plants.
Department of Highways	Consistency of pro- jects with CZM pro- gram		

Table VI-4 (Continued)

AGENCY	GENERAL PRESERVATION	SPECIFIC AREA PRESERVATION	ACTIVITY STANDARDS
Department of Social and Health Services	Protect public water supplies, certify commercial shellfish beds		Solid and liquid waste disposal, pesticide application, marinas and recreational facilities, on-site sewage disposal, waste outfalls.
Parks & Recreation Commission, Interagency Committee for Outdoor Recreation (IAC), State Comprehensive Outdoor Recreation and Open Space Plan (SCORP)	Floodplains and wetlands along "rivers of state-wide significance". Swamps, marshes, & bogs with unique value for wildlife conservation, scientific, educational or recreation purposes. Acquisition of shorelands for public use.		Marinas, boat launch ramps, activities potentially degrading water quality.
Office of Archeology and Historic Preservation	Preservation and conservation of archeologic and historic sites		
<u>REGIONAL</u> Puget Sound Council of Governments	Swamp, marsh, bog, and other wetlands with value for wildlife conservation, scientific, educational, or recreational purposes, natural drainage function		Agriculture, activity centers, public services, housing, transportation.

Table VI-4 (Continued)

AGENCY	GENERAL PRESERVATION	SPECIFIC AREA PRESERVATION	ACTIVITY STANDARDS
	tions. Publicly owned tidelands for public use		
<u>LOCAL</u> Snohomish County Planning Department a) Comprehensive Plan	Conserve open space, agricultural land, scenic areas	Greenbelt on entire east bank Ebey Slough in Marysville Planning Area. Greenbelt. 4. Quilceda Creek.	
b) Shoreline Management Master Program	Existing or potential agricultural or agricultural areas	Areas designated National and Conservancy (see Plate 16, Technical Document).	Activities under SMA, particularly agriculture, log rafting, marinas, dredging and filling, jetties, bulkheads, utilities, flood protection.
Snohomish Health District	Opposes filling with biodegradable material if possibility of water quality degradation	Opposes woodwaste landfill in floodplain	Water quality monitoring, sewage disposal, solid waste management, health aspects of all activities.
Snohomish Conservation District	Agricultural land, unique lands, natural scenic areas, historical sites. Fish and wildlife habitat, wetlands, wilderness and recreation lands		Erosion control measures, restoration of shoreline vegetation and stream resting areas, flooding and drainage control measures, agricultural pollution control.

Table VI-4 (Continued)

AGENCY	GENERAL PRESERVATION	SPECIFIC AREA PRESERVATION	ACTIVITY STANDARDS
City of Everett a) Community Plan b) Shoreline Master Program c) Park Plan	Streams, groundwater recharge areas, agricultural lands, floodplains, tidal flats	11. Jetty Island, undeveloped banks of Snohomish River (except Lowell area), river floodplain	Industrial location, log storage location.
	Areas with unique, fragile and valuable biological resources	11. Jetty Island, 9. Maulsby Swamp, Conservancy shorelines.	All SMA activities.
		See Plate 19, Technical Document	
City of Marysville Shoreline Master Program	Fragile natural resources, areas with rare, unique, or endangered species	4. Quilceda Creek	Dike location.
Snohomish River Basin Mediated Agreement	Preserve delta lobes and biologically functioning surge plains, agricultural lands and wetlands essential to biological and hydrological nature of river	1. Otter Island 2. North Ebey Island east of I-5 4. Quilceda Creek 7. Highway 2 13. Entrance Mudflats (portion of) See Plate 17, Technical Document	
Port of Everett	Fragile and critical estuarine environment. Mix of uplands, tidal land, wetlands	Wetlands, delta lobes, surge plains of Snohomish River estuary which lie and are situated north of Preston Point.	Locational for boat launch, marina, deep/shallow draft shipping, filling, dredged material disposal.

Table VI-4 (Continued)

AGENCY	GENERAL PRESERVATION	SPECIFIC AREA PRESERVATION	ACTIVITY STANDARDS
		<p>For non-disposal of dredged material, areas north and east of main channel of Snohomish River estuary, Plate 17, Technical Document</p> <p>11. Jetty Island</p> <p>12. Jetty Island Mud-flats.</p>	<p>Recreational use, public access.</p> <p>Activities on Jetty Island.</p>
School Districts	Marine and freshwater habitat, for educational and scientific study	<p>4. Quilceda Creek</p> <p>11. Jetty Island</p> <p>18. Tulalip Bay</p> <p>Also, Smith Island, Priest Point, Ebey Island, Union and Steamboat Sloughs.</p>	
Tulalip Tribes Tulalip Reservation Comprehensive Plan	Drainageways, fish and wildlife habitat		Location of marinas, residential and other development, sewer and water lines.